# ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK USING VERAPAMIL AS AN ADJUVANT TO LOCAL ANAESTHETIC FOR UPPER LIMB SURGERY

**DISSERTATION SUBMITTED FOR THE DEGREE OF DOCTOR OF MEDICINE**

**BRANCH – X (ANAESTHESIOLOGY)**

**MAY-2019**


**THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY**

**CHENNAI, TAMILNADU**

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## DECLARATION

I, **Dr.G. MANIKANDAN** solemnly declare that, this dissertation titled "**ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK USING VERAPAMIL AS AN ADJUVANT TO LOCAL ANAESTHETIC FOR UPPER LIMB SURGERY"** has been done by me. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree or diploma to any other University or board either in India or abroad.

This is submitted to The Tamilnadu DR.M.G.R Medical University, Chennai in partial fulfillment of the rules and regulations for the award of Doctor of Medicine degree branch X (Anaesthesiology) to be held in MAY 2019.

Date:

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## ACKNOWLEDGEMENTS

With great reverence, I extend my deep sense of gratitude to respected guide **Dr.R.Selvakumar M.D.,D.A.,D.N.B., Professor, Institute of Anaesthesiology and critical care**, for his advice, able guidance, constant inspiration, constructive criticism and novel suggestions throughout my post graduate study, without whose initiative and enthusiasm, this study would not been completed.

My sincere thanks to **Dr.M.KALYANASUNDARAM M.D.,** DIRECTOR, Institute of Anaesthesiology and critical care who supported and guided me in each and every step of my work.

My sincere thanks to **Dr.D.S. SUDHAKAR M.D.,** Assistant professor, Institute of Anaesthesiology and critical care who supported and guided me in each and every step of my work.

I am thankful to all my Assistant Professors, Professors, My Colleagues, Seniors, Juniors and All Other Staff Members Institute of Anaesthesiology And Critical Care for their constant support and guidance in completing this study.

I thank my Parents, wife and Family members for their support during the course of study.

I also thank my collaborating department, **Department of Plastic surgery** who allowed me to perform my study at their theatre.

I thank **The Dean, Government Rajaji Hospital and Madurai Medical College, Madurai** for permitting me to utilize the college and hospital for my study. Lastly, I sincerely thank all of my patients for their kind cooperation during the course of the study.

Date:

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**Dr.G.MANIKANDAN**

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# INTRODUCTION

Majority of Upper limbs surgeries are done under nerve blocks. In the last decade image guided peripheral nerve block have become the norm for the anesthesiologist at the forefront of regional anaesthesia. Out of that dominant method of imaging is ultrasonography. Ultrasound can determine the size, depth, and exact location of the brachial plexus and its neighboring structures. Real-time ultrasound imaging can help to guide the block needle to reach target nerves with fewer attempts. Under visual guidance, needle movement is purposeful and based on constant image feedback, thus avoiding nerve localization by trial and error. Various adjuvants were used as adjuvant for supraclavicular block, but many of them leads to side effects, here we used verapamil calcium channel blocker as adjuvant. Calcium plays an important role in pain formation. Verapamil (calcium channel blocker) has been shown to have potent local anesthetic activity, reflecting inhibition of fast sodium channels. It induces fast channel blocking effects similar to local anesthetics.

## CLINICAL ANATOMY

### BRAXHIAL PLEXUS:

The brachial plexus formed by anterior primary rami of cervical (C5,C6,C7,C8) and 1st thoracic segment. The plexus consists of roots, trunks, divisions, cords and branches. Most commonly formed by C5 to T1. However, variations may occur where C4 to C8 is known as prefixed plexus and C6 to T2 known as post fixed plexus. C4 mainly contributes to prefixed plexus. T1 mainly contributes to post fixed plexus. It provides cutaneous and motor innervation of entire upper limb with few exceptions. Prefixed plexus is associated with cervical rib likewise in post fixed plexus anomalous origin of 1st rib.

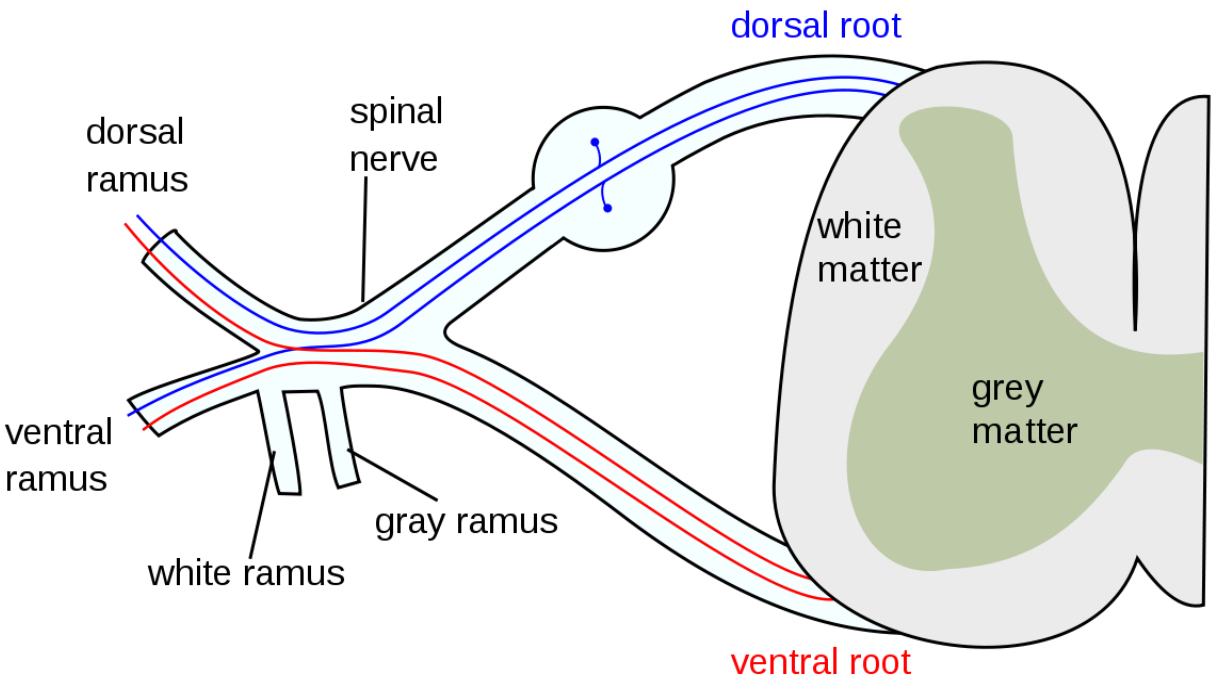



Fig no 1: Mixed fibers of roots of brachial plexus

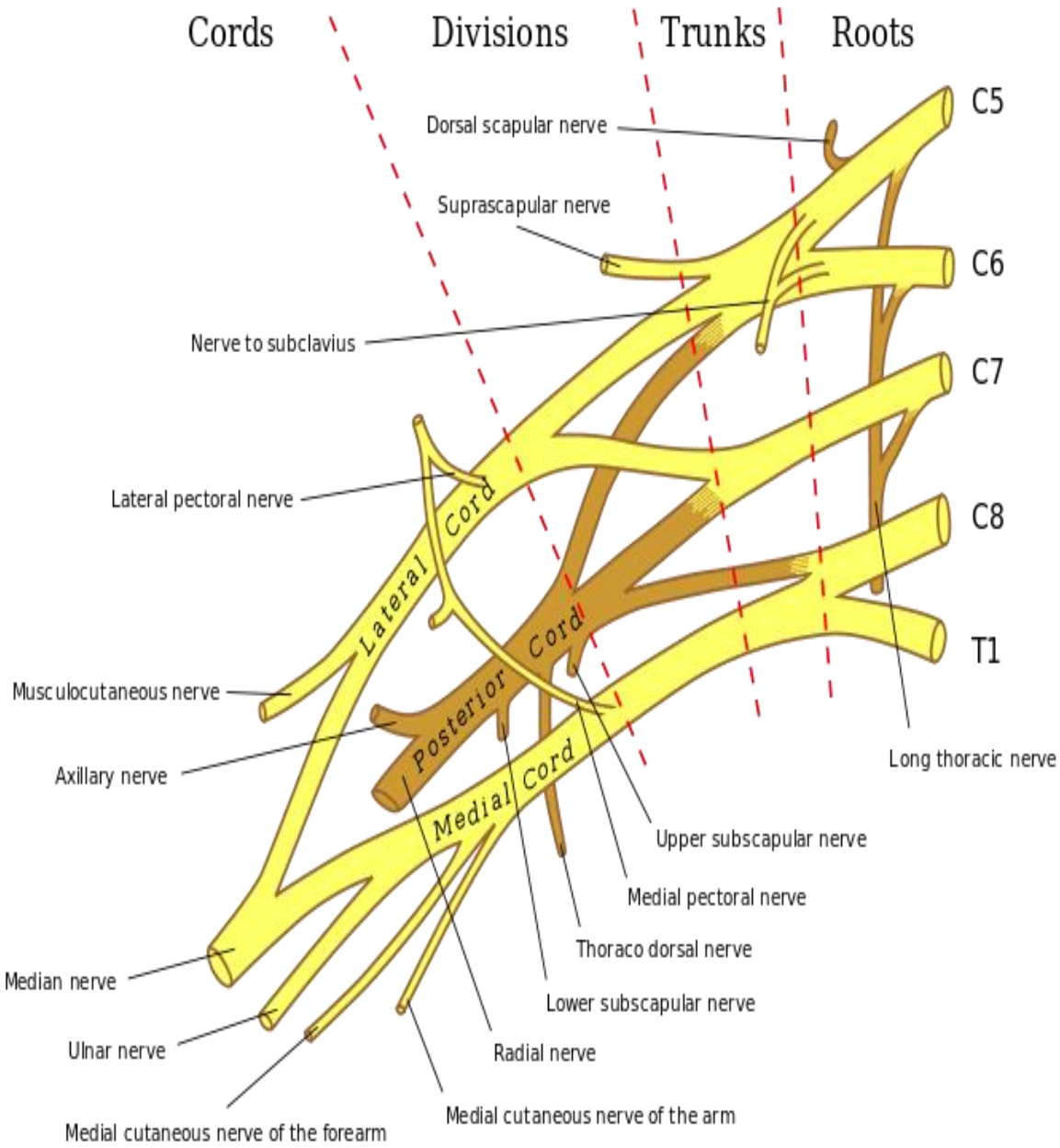



Fig no: 2 Brachial plexus

**ROOTS:**

The Roots emerge from the intervertebral foramen. They pass behind the foramen transversarium of the corresponding cervical vertebrae with its contained vertebral vessels and then lie in the transverse process in the groove between the anterior and posterior tubercles. All the roots lie between the scalenus anterior and scalenus medius muscle. In the groove they lie in a fibrofatty sheath. The anterior part of the sheath arises from the anterior tubercle which covers the posterior part of Scalenus anterior muscle. The posterior part of the sheath arises from posterior tubercles covering the front of Scalenus medius muscle.

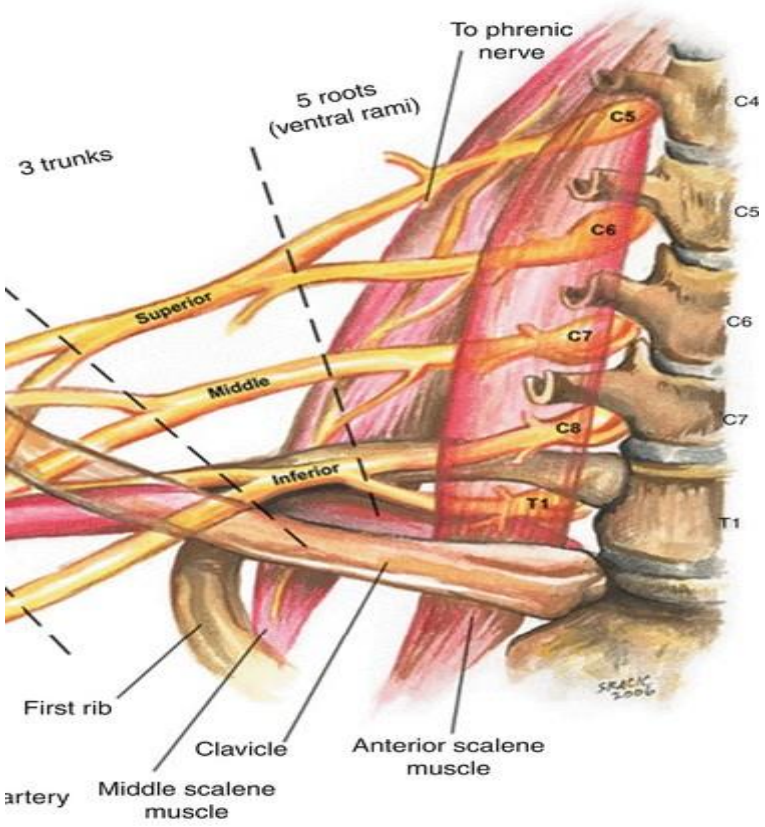



Fig no. 3: Roots of Brachial plexus

The roots lie in the posterior triangle of neck. The roots lie above the second part of subclavian artery.

The roots receive:

**1.** Grey rami from cervical sympathetic chain

**2.** C5 and C6 from middle cervical ganglion

**3.** C7 and C8 from inferior cervical ganglion

4. T1 from ganglion of T1.

The branches arising from the Roots:

1. Nerve to rhomboids (dorsal scapular nerve C5)
2. Nerve to serratus anterior or long thoracic nerve or nerve of bell (C5-C7)
3. Branches to longus colli (C5-C8)
4. Branches to scaleni muscles (C5-C8)
5. Branch to phrenic nerve (C4)

**TRUNKS:**

The upper trunk is formed by the union of C5 and C6 roots.

The middle trunk is formed by C7

The lower trunk is formed by the union of C8 and T1.

They emerge as trunks from between the scalene group of muscles, crossing the posterior triangle goes across the first rib. In the posterior triangle of neck trunks lie deep to the floor of the triangle. Behind the clavicle at the lateral border of first rib, trunks divide into anterior and posterior division. And it enters the axilla via cervico axillary canal where they join to form the cords.

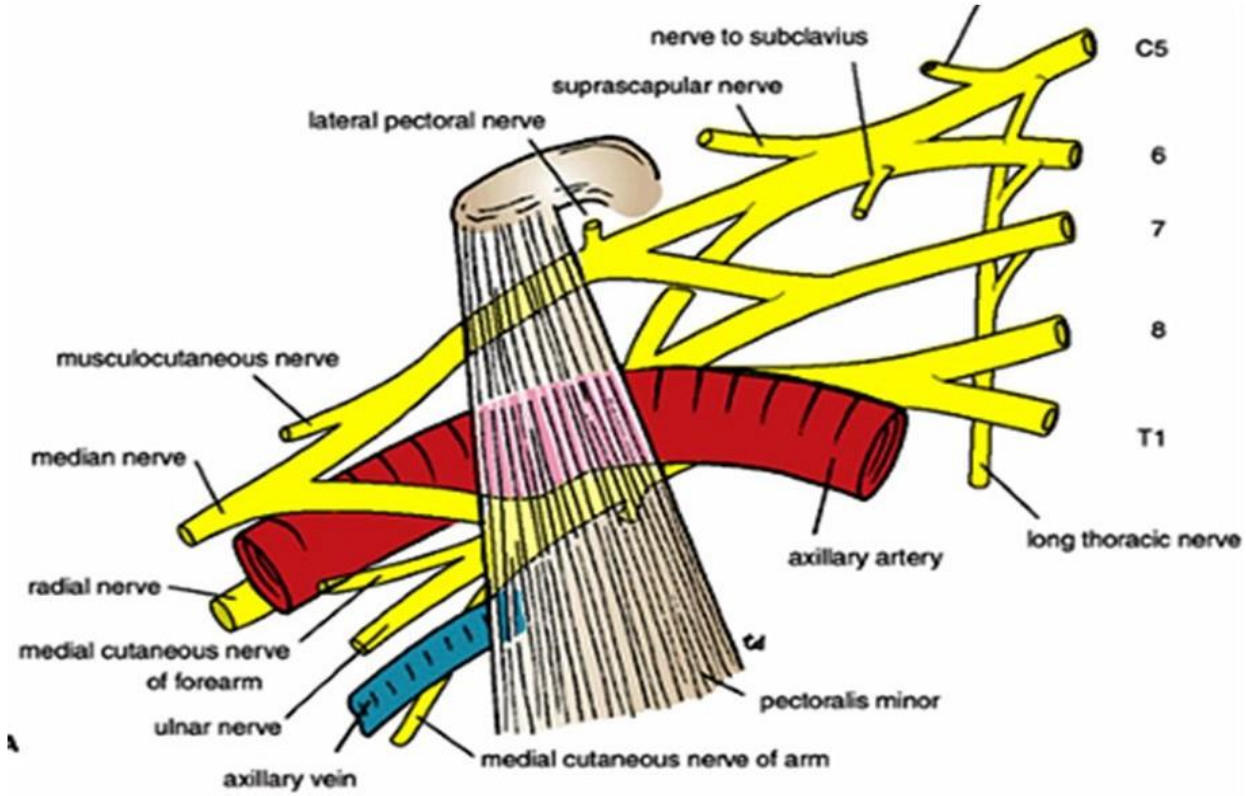



Fig no 4: Relations of Trunk

Trunks invested in prevertebral fascia are superficial and covered only by skin, platysma and deep fascia. However, crossed by – the inferior belly of omohyoid, the external jugular vein, the transverse cervical artery and the supraclavicular nerves. The upper and middle trunk lies above the subclavian artery. The lower trunk lies behind the artery.

**Branches Arising from Trunks**

1. The branches arising from the trunks of the brachial plexus are:
    a. Nerve to the subclavius
    b. Suprascapular nerve.
2. The **nerve to the subclavius** descends in front of the brachial plexus and in front of third part of the subclavian artery. It passes behind the clavicle to reach the deep surface of the subclavius that it supplies.
3. The **suprascapular nerve** runs laterally and backwards over the shoulder.

**CORDS:**

The cords are named according to their relationship to axillary artery.

1. Lateral cord
2. Medial cord
3. Posterior cord

**Lateral cord**- anterior divisions of upper and middle trunk unite to form the lateral cord. It lies lateral to the first and second part of axillary artery before giving branches.

a) lateral pectoral nerve (C5–7)

b) musculocutaneous nerve (C5–7)

c) lateral root of median nerve (C6, C7).

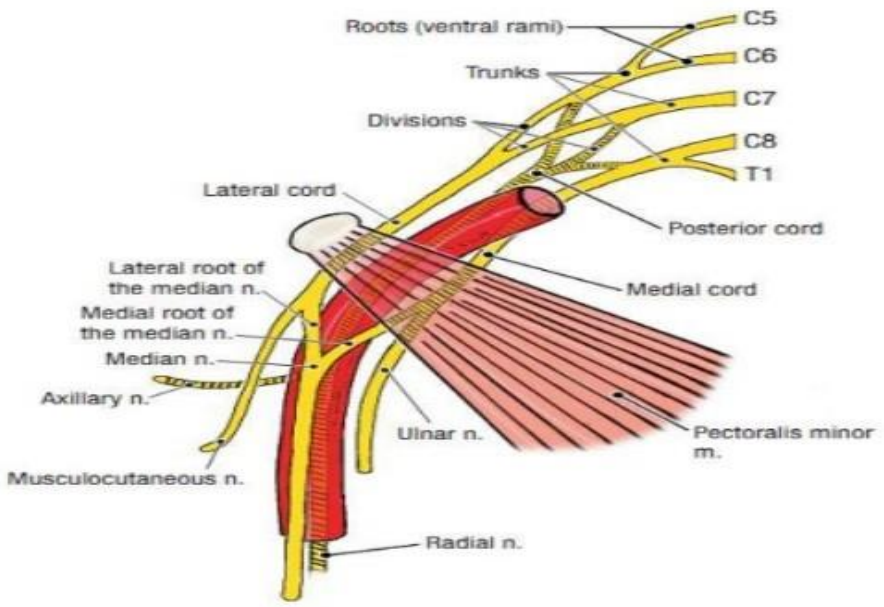



Fig no.5 Relation to Axillary artery

**Medial cord:**

The anterior division of lower trunk forms the medial cord. It lies posterior to the first part of axillary artery with its medial pectoral branch. It lies medial to the second part of axillary artery.

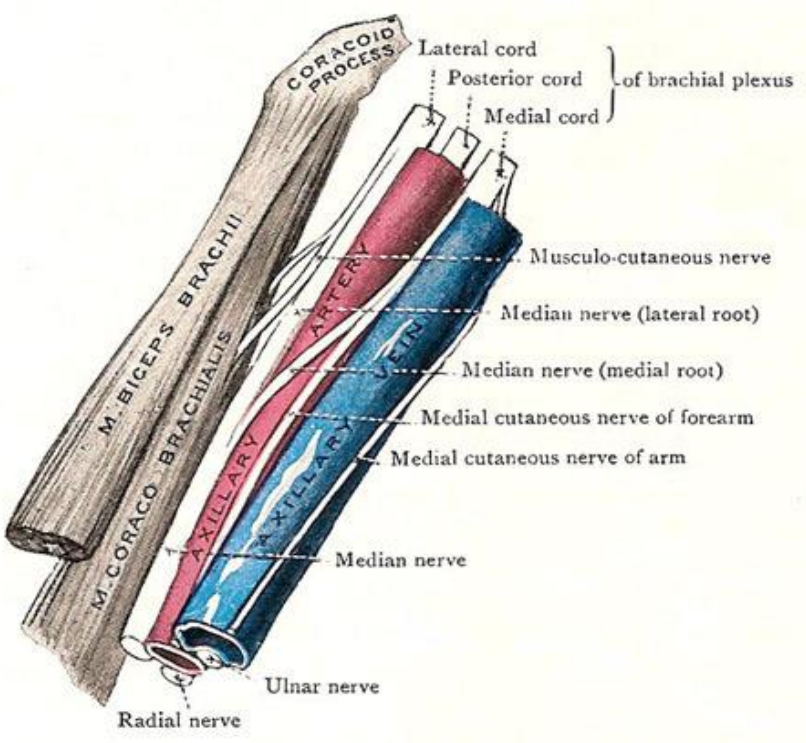



Fig no 6: Medial cord

**Branches:**

a) Medial pectoral nerve (C8, T1)

b) Medial cutaneous nerve of arm (C8, T1)

c) Medial cutaneous nerve of forearm (C8, T1)

d) Medial head of median nerve (C8, T1)

e) Ulnar nerve (C7–8, T1)

**POSTERIOR CORD:**

Posterior division of all the three trunks unite to form the posterior cord. It lies lateral to the first part of axillary artery and posterior to the second part.

**Branches:**

a) Upper subscapular nerve (C5, C6)

b) Nerve to latissimus dorsi (thoracodorsal nerve) (C6–8)

c) Lower subscapular nerve (C5, C6)

d) Axillary nerve (C5, C6)

e) Radial nerve (C5–8, T1).

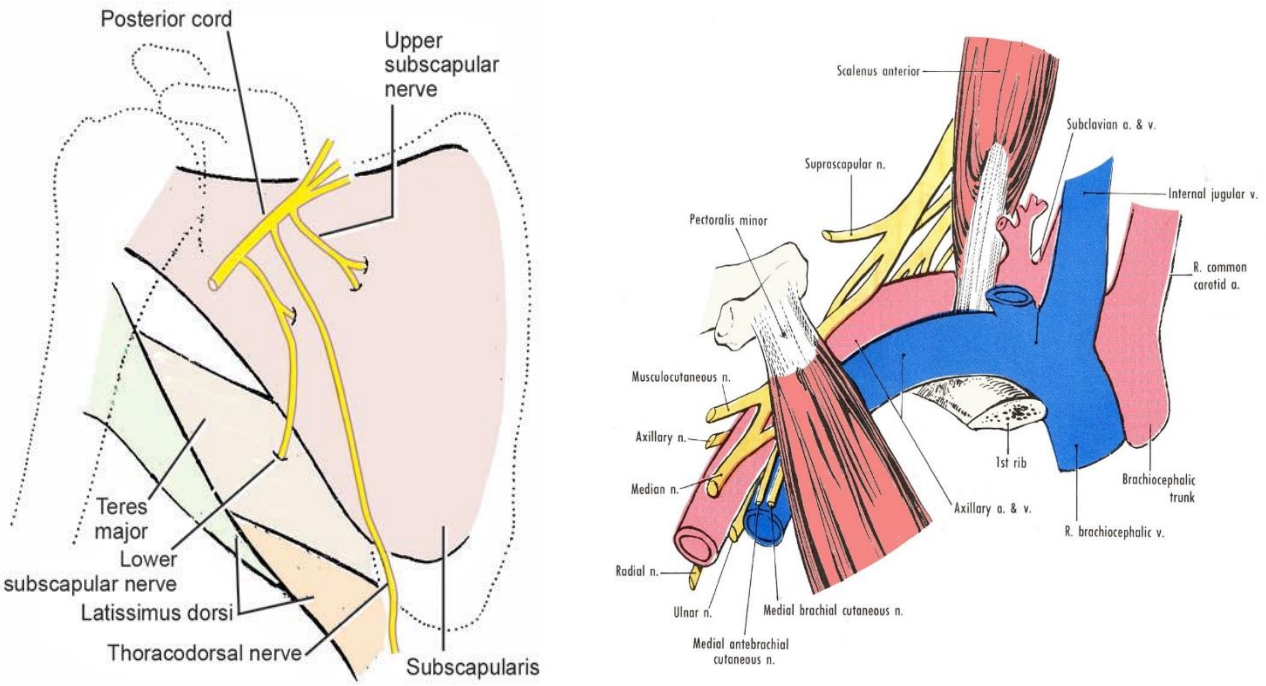



Fig no 7: Posterior cord

# ULTRASONOGRAM

Ultrasound allows noninvasive visualization of tissue structures. Ultrasound sound guided nerve block have become very popular and it is essential in regional anaesthesia. In 1880, French physicists Pierre Curie and Paul-Jacques Curie, discovered the piezoelectric effect, which can generate and receive mechanical vibrations with high frequency. In 1978 P.La Grange and his colleagues published a case series report of ultrasound application for peripheral nerve block. In 61 patients they performed Supraclavicular brachial plexus block for which they used doppler transducer to locate the subclavian artery.  In 1989 Ting and Sivagnarathnam used B mode ultrasound and demonstrated anatomy of axilla and axillary brachial plexus block drug spread.

Ultrasound is high-frequency sound and refers to mechanical vibrations above 20 kHz. Ultrasound frequencies commonly used for medical diagnosis are between 2 and 15 MHz

The piezoelectric effect is an effect exhibited by the generation of an electric charge in response to mechanical force applied on certain materials. Mechanical deformation can be produced when an electric field is applied to such material, also called the piezoelectric effect.

Quartz crystals, ceramic materials and Lead zirconate titanate are materials that exhibit piezoelectric effect. Lead free piezoelectric materials are under development.

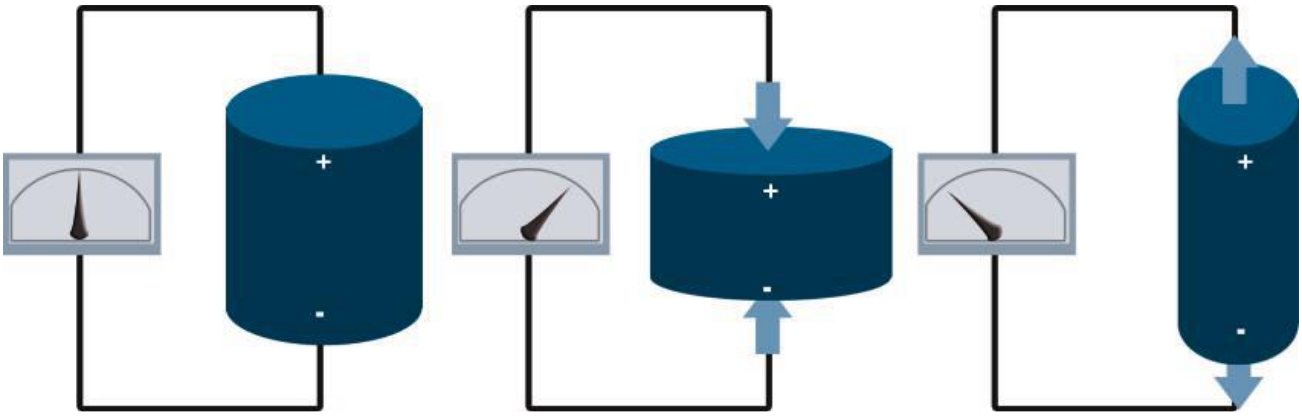



Fig no 8: piezoelectric effect

While passing through the tissue's ultrasound wave comes across various interactions like reflection, scattering and absorption.

Where there is a boundary between different media part of ultrasound is reflected and the rest is transmitted. The reflection intensity is solely dependent on the angle which means the transducer should be placed perpendicular to the target nerve for clear visualization.

The coupling medium is necessary to displace the air from the transducer and air interface. Gels and oils are used for this purpose they act as lubricants providing a smooth surface scanning.

Scattering is redirection of ultrasound waves by rough surface or heterogeneous media.

## B MODE:

The primary mode used in regional anesthesia. It provides cross sectional image for the area of interest. In this, there is simultaneous scanning from a linear array of 100-300 piezoelectric crystals. The amplitude of the echo is converted into dots of different brightness in B scan. The echo strength is indicated by the gray scale intensity and real distance in tissues is represented by horizontal and vertical distances.

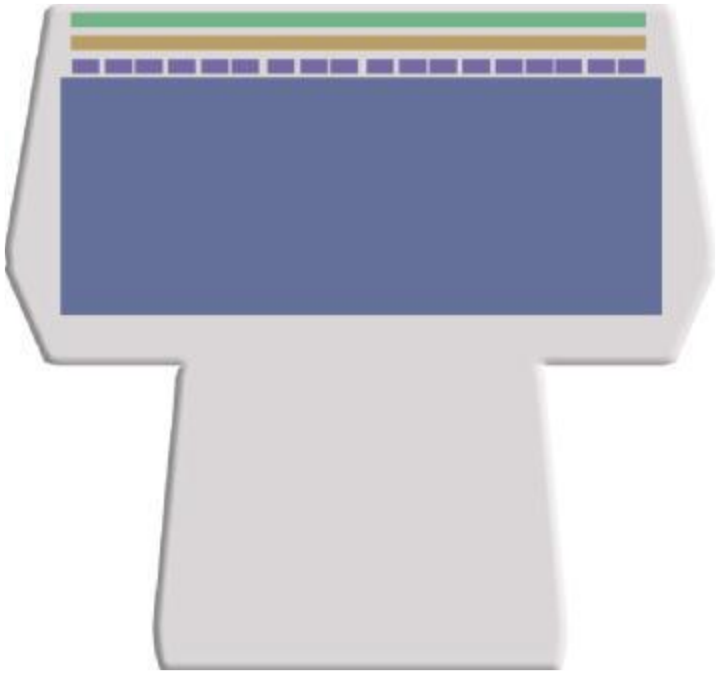


Fig no 9: B mode transducer

**DOPPLER MODE**- to detect the presence and nature of blood vessels.

In regional anaesthesia two types of transducers are used- Linear and curvilinear transducers.

| Linear | Curvilinear |
|---|---|
| Rectangular | Curvilinear in shape |
| Beam is rectangular, and the near-field resolution | Convex beam and in-depth examinations |
| 2 to 16 MHz | 2 to 7 MHz |

Table 1- linear and curvilinear probe

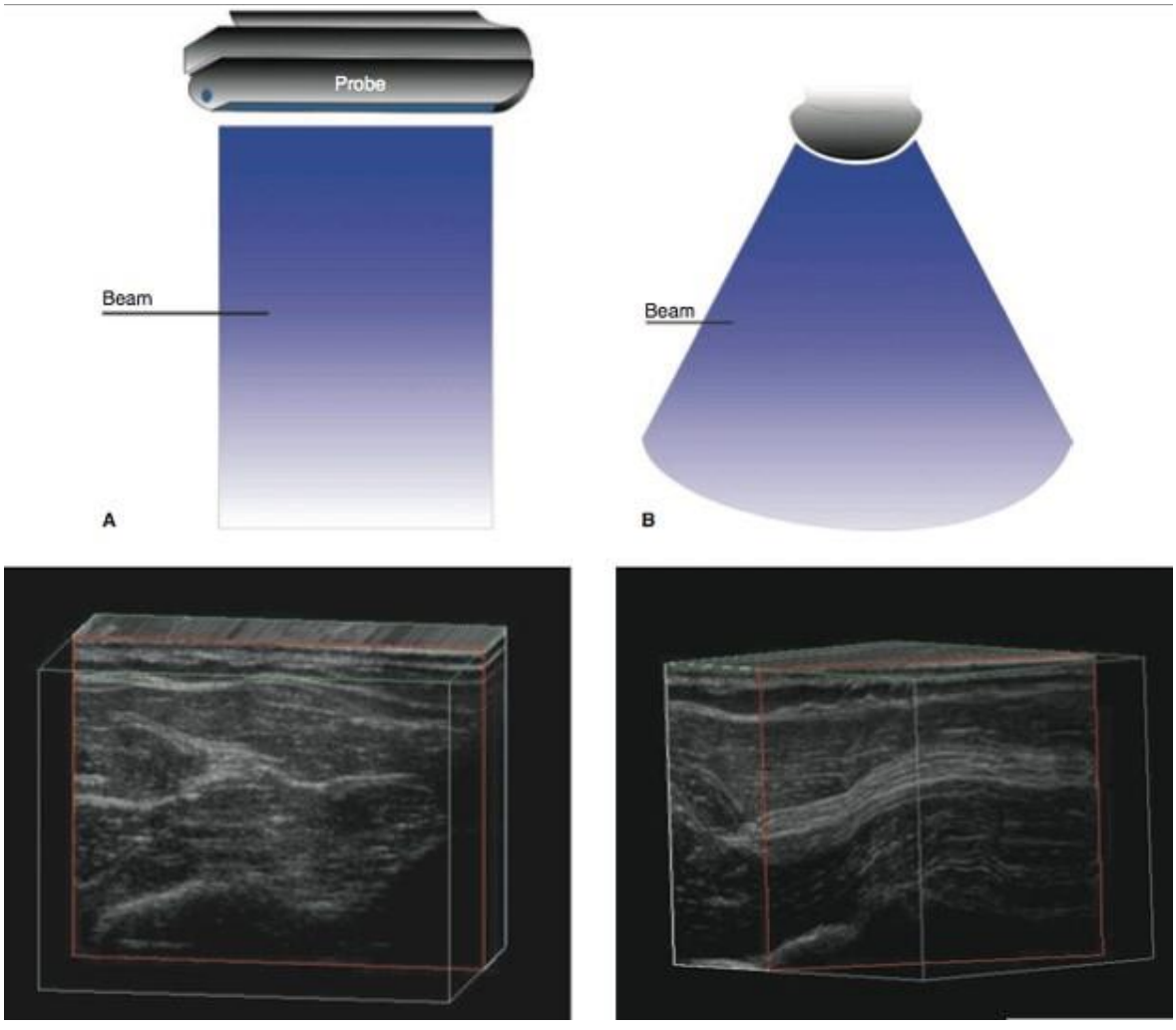



Fig no 10: Transducer

The peripheral nerves are in close vicinity to the vessels or between the muscle layers in general. The echo texture can be hyperechoic, hypoechoic or honeycomb pattern. To facilitate adequate nerve imaging, proper selection of sonographic modes, functional keys adjustment, needle visualization and image artifact interpretation are the certain steps. For peripheral nerve visualization three imaging modes are commonly used- conventional imaging, compound imaging and tissue harmonic imaging (THI).

For achieving an optimal image while performing peripheral nerve imaging five functional keys on an ultrasound machine play vital role

1) **Depth 2) Frequency 3) Focusing 4) Gain 5) Doppler**

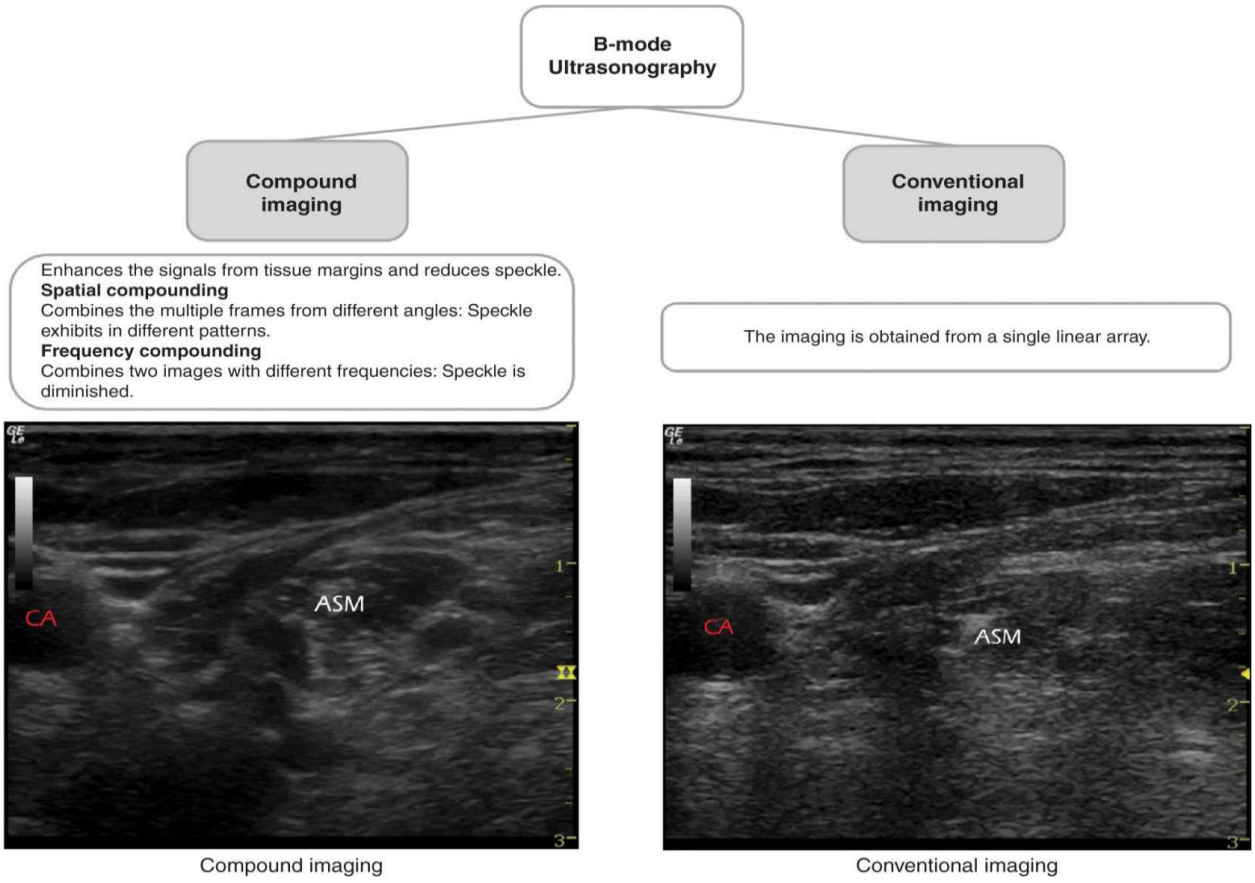



Fig no 11: Compound and Conventional Imaging

With the relevance to needle -transducer relationship, two needle insertion techniques are being used commonly.

**In-plane technique:** Needle is placed in the plane of ultrasound beam. Hence the needle shaft and tip can be observed in the longitudinal view when it is advanced towards the target structure. One should stop advancing the needle when the needle visualization fails. Tilting or rotating the transducer can help with visualization.

**Out of plane technique:** The needle is inserted perpendicular to the transducer. The shaft of the needle is seen in the cross-sectional plane and as a bright dot.

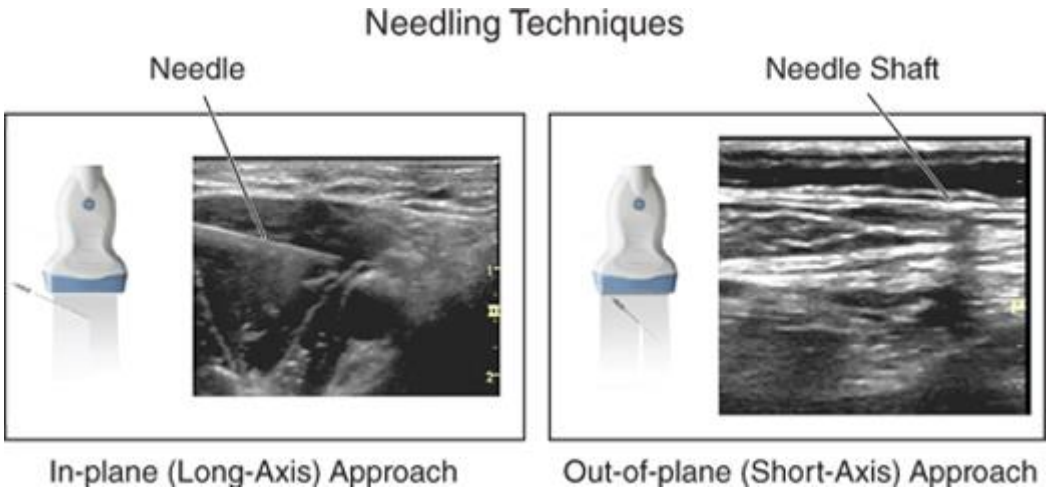



Fig no 12: In-plane and out of plane technique

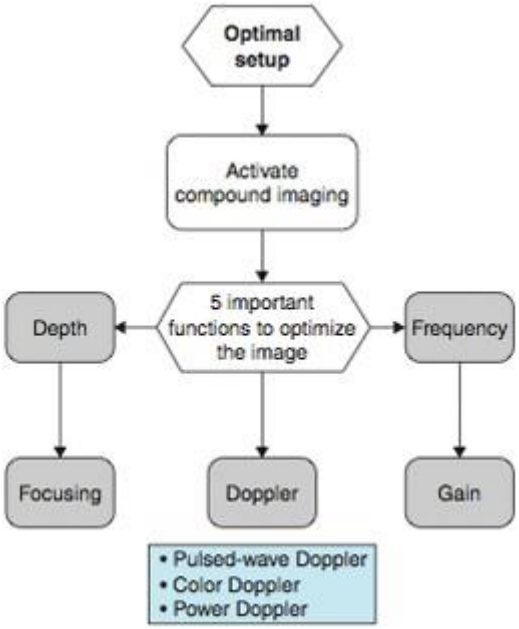



Fig no 13: Operational setup

| FIELD DEPTH (CMS) | FREQUENCY (MHZ) | PERIPHERAL BLOCKADES |
|---|---|---|
| < 2 | 12-15 | Wrist, ankle block |
| 2-3 | 10-12 | Interscalene and axillary |
| 3-4 | 10-12 | Femoral, Supraclavicular and TAP |
| 4-7 | 5-10 | Infraclavicular, Popliteal and sub gluteal sciatic nerve block |
| 7-10 | 5-10 | Pudendal, gluteal sciatic and lumbar plexus block |
| >10 | 3-5 | Anterior approach to sciatic nerve |

Table no 2: Imaging depth and frequency for common peripheral nerve blocks

## ULTRASOUND ARTIFACTS:

Ultrasound artifact is any image aberration that does not represent the correct anatomic structures. Most artifacts are undesirable, and operators must learn how to recognize them during nerve blockade.

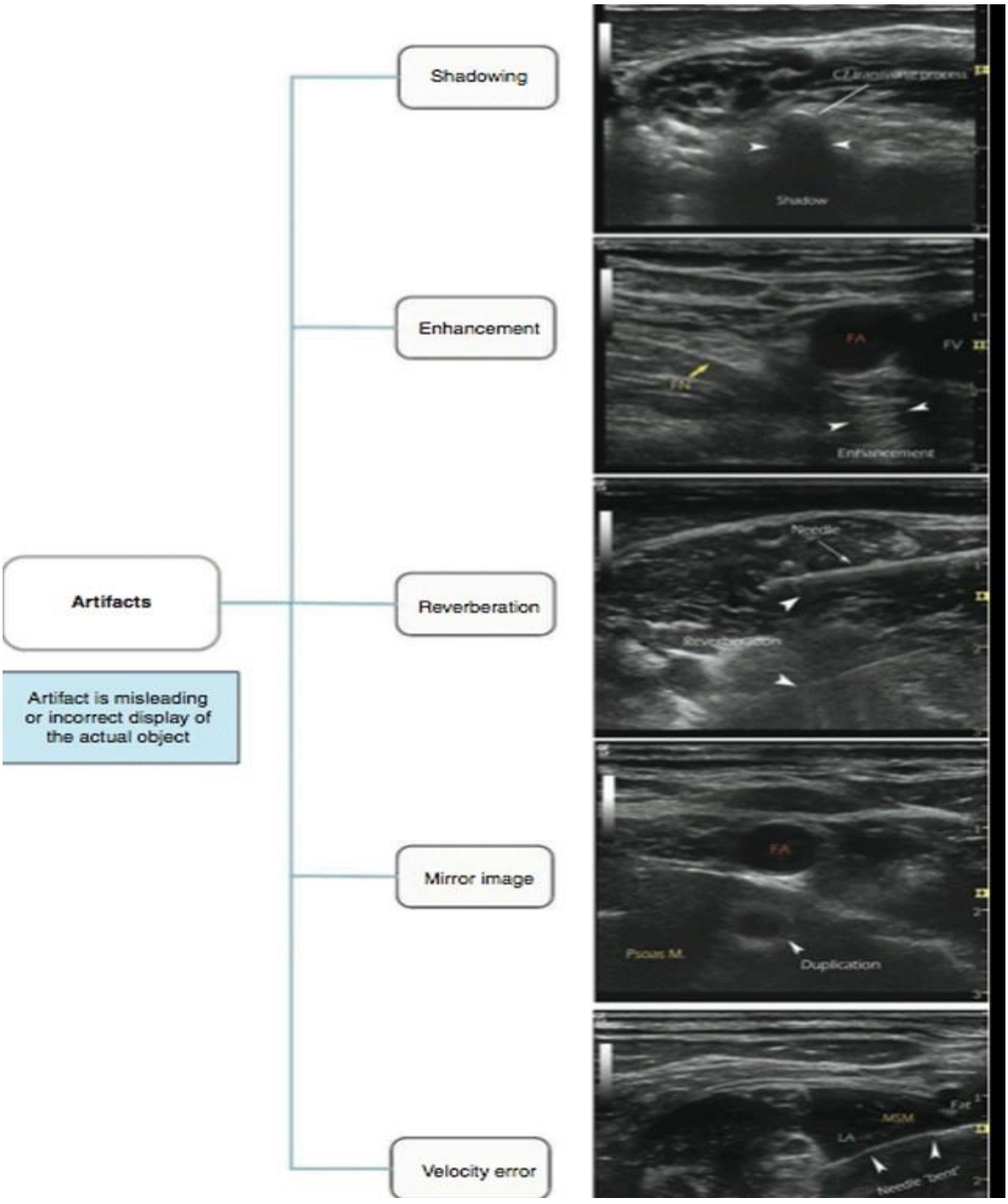
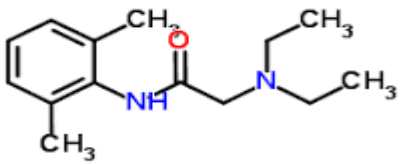



Fig no 14: Artifacts

## LIGNOCAINE

- Lignocaine an aminoethyl amide an amide group local anaesthetic.




- Introduced in 1948
- Most widely used local anaesthetic and also an antiarrhythmic agent.
- Lidocaine produces faster, more intense, longer-lasting, and more extensive anesthesia than does an equal concentration of procaine.
- It blocks the nerve conduction by decreasing the entry of sodium ions during the upstroke of action potential.
- Once the concentration of local anesthetics increases the rate of rise of action potential and the maximum depolarization decreases causing slowing of conduction. Hence local depolarization doesn't reach the threshold potential and conduction block ensues.
- Lidocaine is absorbed rapidly after parenteral administration and from the GI and respiratory tracts.
- Lidocaine is dealkylated in the liver by CYPs to monoethylglycine xylidide and glycine xylidide, which can be metabolized further to monoethylglycine and xylidide.

- Both monoethylglycine xylidide and glycine xylidide retain local anesthetic activity.
- About 75% of the xylidide is excreted in the urine as the further metabolite 4-hydroxy-2,6-dimethylaniline.
- Duration of action after infiltration- 60-120 minutes
- Maximum single dose for infiltration – 300mg
- pKa- 7.9
- Protein binding – 70%
- Nonionized fraction at pH 7.4- 25%
- Nonionized fraction at pH 7.6- 33%
- Lipid solubility- 2.9, Volume of distribution- 91 liters (L)
- Clearance – 0.95 L/min.
- Elimination half time – 96 minutes

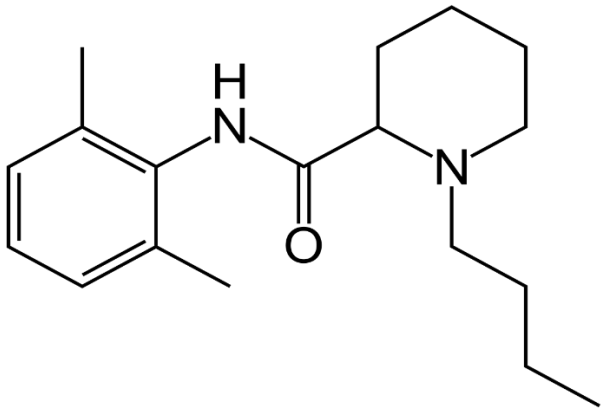
**Dose-Dependent Effects of Lidocaine**

| Plasma Lidocaine Concentration (μg/mL) | Effect |
|---|---|
| 1–5 | Analgesia |
| 5–10 | Circumoral numbness |
| | Tinnitus |
| | Skeletal muscle twitching |
| | Systemic hypotension |
| | Myocardial depression |
| 10–15 | Seizures |
| | Unconsciousness |
| 15–25 | Apnea |
| | Coma |
| >25 | Cardiovascular depression |

Table no 3: Effects of lignocaine

# BUPIVACAINE

- Bupivacaine is a widely used amide local anesthetic.
- Similar to that of lidocaine except that the amine-containing group is a butyl piperidine.
- Potent anaesthesia producing long lasting effect.

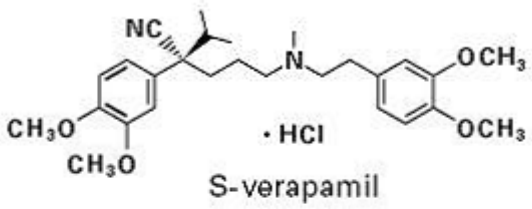



- First synthesized in 1957 by Ekenstam
- More sensory than motor blockade has made it popular drug for prolonged postoperative pain and labour analgesia.
- Recently liposomal derived bupivacaine was approved by FDA
- More slowly absorbed than lignocaine.
- Bupivacaine is primarily metabolized in the liver by CYP3A4 to pipecolylxylidine, which is then glucuronidated and excreted.
- Alpha 1 acid glycoprotein important plasma protein site of bupivacaine.
- Duration of action after infiltration- 240-480 minutes
- Maximum single dose for infiltration – 175mg
- pKa- 8.1
- Protein binding – 95%

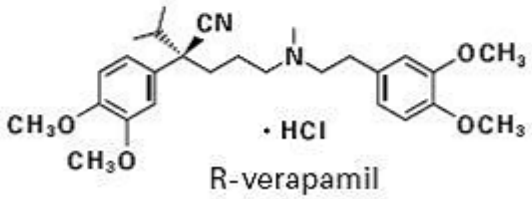
- Nonionized fraction at pH 7.4- 17%
- Nonionized fraction at pH 7.6- 24%
- Lipid solubility- 28
- Volume of distribution- 73 liters (L)
- Clearance – 0.47 L/min.
- Elimination half time – 210 minutes
- IV injection of bupivacaine result in precipitous hypotension, cardiac dysrhythmias, and atrioventricular heart block.
- QT prolongation, ventricular tachycardia most common side effect.
- Cardio toxic dose occurs at plasma concentration 8-10 mcg/ml
- Cardio toxicity sensitivity is more in pregnancy
- Drowsiness occurs at plasma concentration 1.5 mcg/ml
- Peripheral paresthesia occurs at plasma concentration 2 mcg/ml
- Convulsions occur at plasma concentration 4 mcg/ml.
- Available hyperbaric forms include concentrations of 0.5% and 0.75%, with dextrose 8.25%.
- Isobaric formulations are available in concentrations of 0.5% and 0.75%.

# VERAPAMIL

- Developed in 1962 in Germany.
- Initially developed as coronary dilator and also have a cardio depressant property.



S-verapamil



R-verapamil

- Phenylalkylamine type of calcium channel blocker.
- L-Verapamil is the more potent Ca2+ channel blocker.
- In the neurons they block the neurotransmitter release.
- It has some alpha-adrenergic blocking activity also.
- It inhibits the transmembrane influx of extracellular calcium ions into myocardial and vascular smooth muscle cells, causing dilatation of the main coronary and systemic arteries and thereby decreasing myocardial contractility.
- Selective inhibition of calcium influx through cellular membranes.
- Class 4 antiarrhythmic agent
- Bioavailability: 20-35%
- Onset: IV, 1-5 minutes
- Duration: IV, 10-20 min; PO, 6-8 hour

- ❖ Peak plasma time: 1-2 hour
- ❖ Protein bound 94%
- ❖ Volume of distribution- 3.8 L/kg
- ❖ Metabolized by hepatic P450 enzyme CYP3A4
- ❖ Metabolites: Norverapamil (active)
- ❖ Half-life: Infants, 4.4-6.9 hour; single dose, 3-7 hour; multiple doses, 4.5 hour; severe hepatic impairment, 14-16 hour
- ❖ Clearance: 0.5-1 L/hour/kg
- ❖ Excretion: Urine (70%), feces (9-16%)
- ❖ Nausea, constipation and bradycardia are common than other calcium channel blockers.
- ❖ Flushing, ankle edema and headache are less common.
- ❖ Should not be given with beta blockers.

## ANTINOCICEPTION:

- Verapamil induces fast sodium channel blocking effects similar to local anaesthetics
- It inhibits calcium influx thereby reducing intracellular calcium, which plays an important role in potentiation of spinal cord and in pain formation (activation of NMDA receptors).

# SUPRACLAVICULAR BLOCK

Ultrasound guided peripheral nerve blocks were first described in the supraclavicular region. In this region the brachial plexus is compact the visibility of the nerve is extremely good and the structures are shallow (20-30mm). The brachial plexus divisions are seen in sonography. Supraclavicular block of brachial plexus provides anaesthesia for upper arm, forearm and hand. Ultrasound-guided supraclavicular block is more reliable for anesthesia of the radial nerve than is ultrasound guided infraclavicular block. Because the inferior trunk is away from the block needle and may behind the subclavian artery, the supraclavicular approach may rarely fail to provide adequate anesthesia in the ulnar nerve. Even in obese patients, the supraclavicular block can be performed with high success and low complication rates.

Fig no: 15 Supraclavicular brachial plexus

Supraclavicular block is often called the “spinal anesthesia of the upper extremity”.

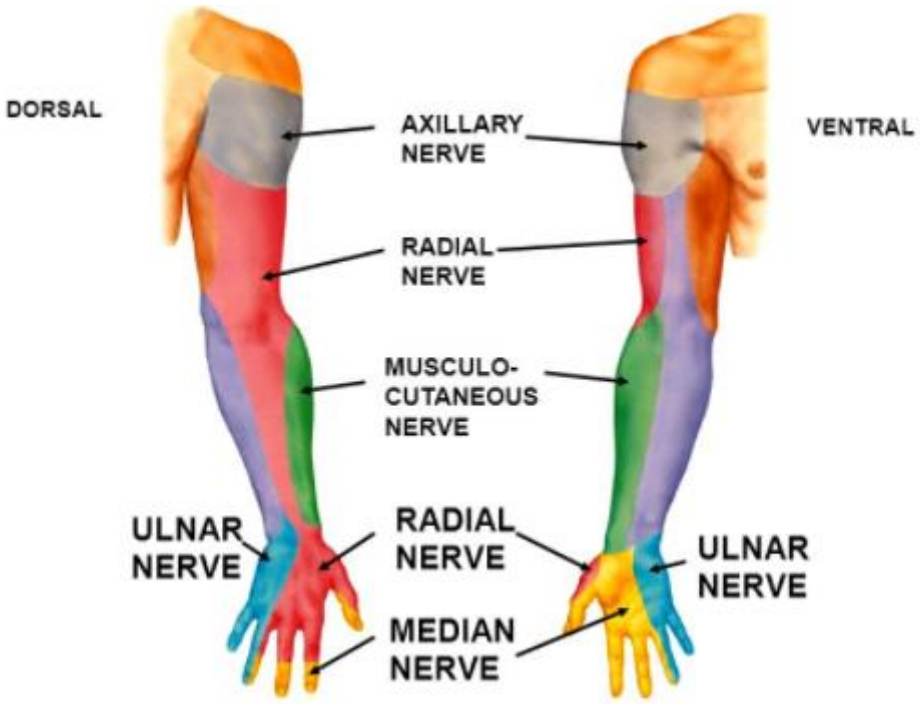



Fig no 16: Sensory Distribution of Upper limb

## ULTRASOUND ANATOMY:

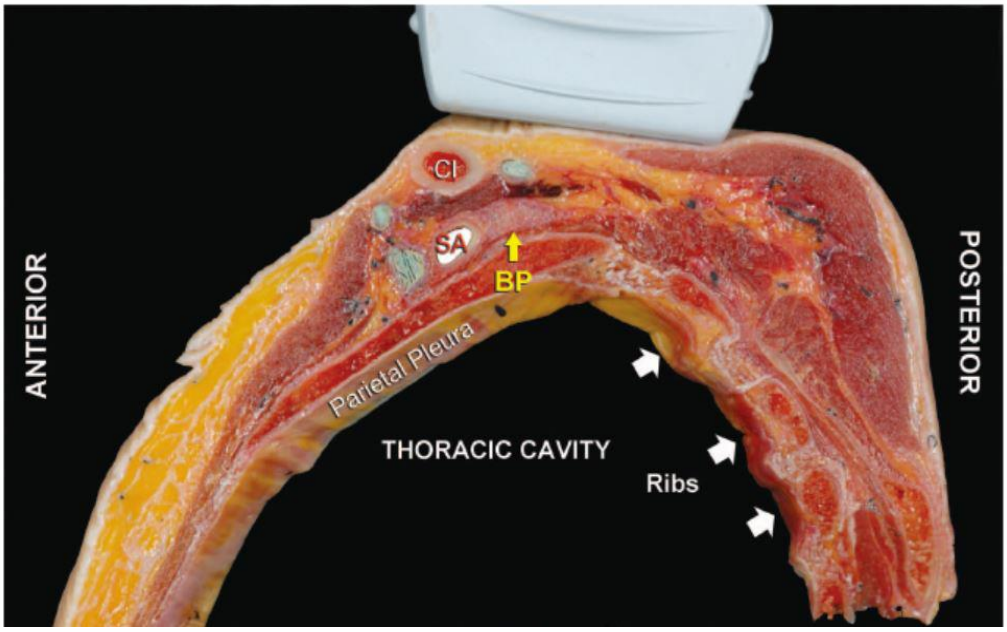



FIG NO:17 Anatomy of the supraclavicular brachial plexus with proper transducer placement

The subclavian artery crosses the first rib between the insertions of anterior and middle scalene muscles, posterior to midpoint of the clavicle. The subclavian artery is seen as an anechoic round structure. The parietal pleura and first rib can be seen as a linear hyperechoic structure lateral and deep to the subclavian artery. The rib casts an acoustic shadow so that the image field deep to rib appears anechoic. The brachial plexus seen as bundle of hypoechoic round nodules just posterior and superficial to the subclavian artery. It is possible to see the fascial sheath of the muscles surrounding the brachial plexus.

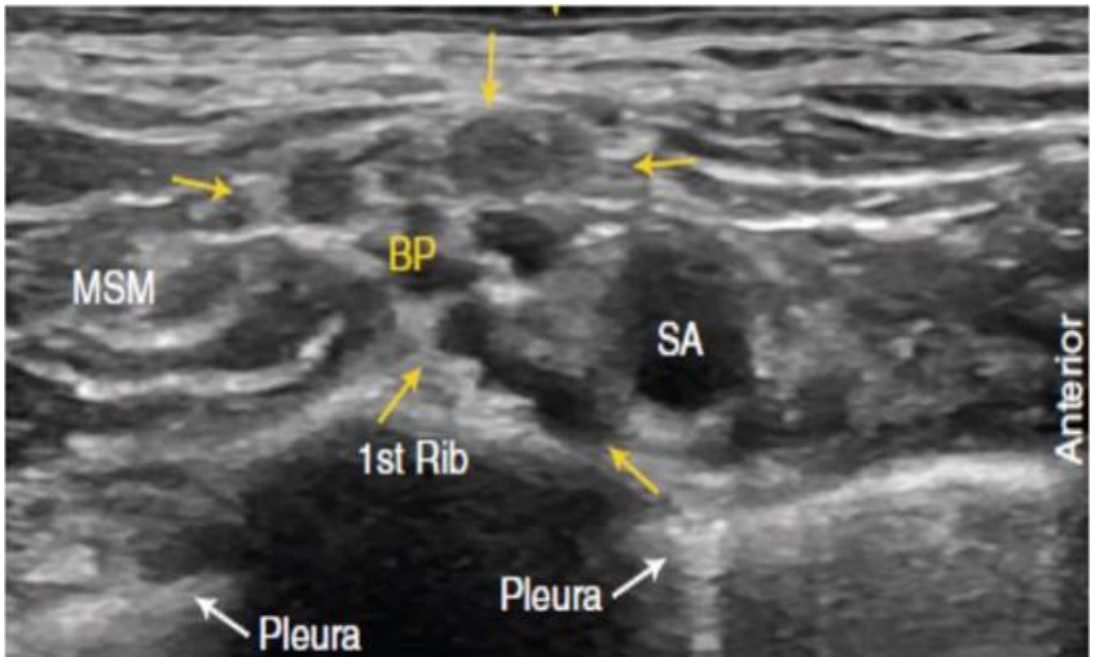



Fig no 18: US anatomy of Brachial plexus

Adjusting the transducer, the upper, middle and lower trunks of the brachial plexus can be individually identified, as they join together at costoclavicular space. To visualize the lower trunk the transducer is oriented in sagittal plane, until the rib is seen deep to plexus and subclavian artery. Anterior or posterior to the rib is hyperechoic pleura with lung tissues deep to it. The brachial plexus is typically seen 1 to 2 cm deep at this location.

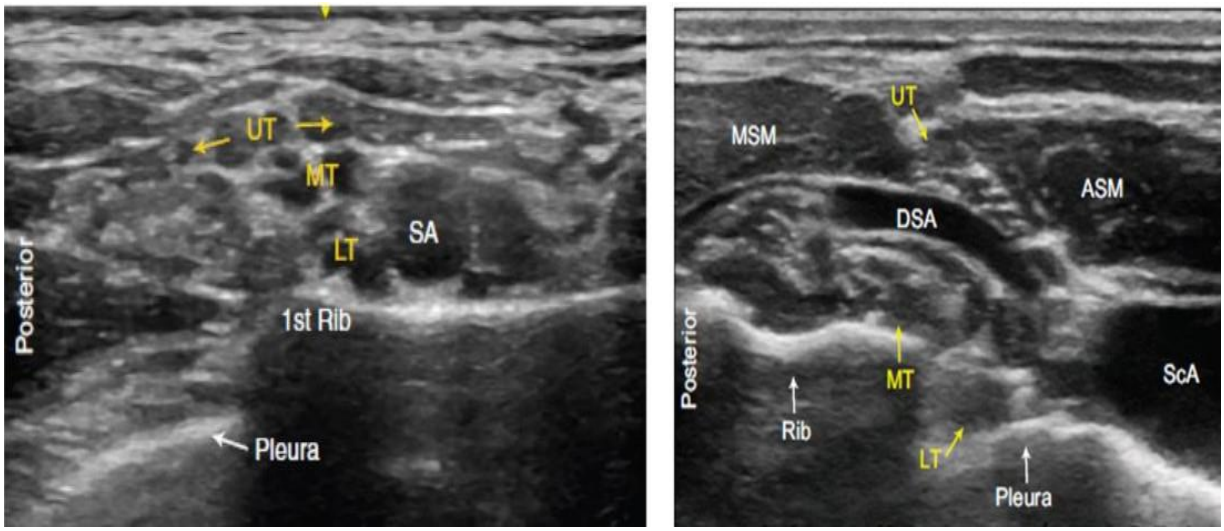



Fig no 19: Ultrasound images of the brachial plexus

Sagittal view and Oblique view

The dorsal scapular artery commonly passes through or within the brachial plexus. It is important to recognize that the superficial and lateral branches come from C5–C7 (shoulder, lateral aspect of arm, and forearm) can be traced up to the interscalene area, whereas the deeper and medial contingent are branches of C8 and T1 (hand and medial aspect of forearm).

Adequate spread of local anesthetic in both areas is necessary for successful block of the arm and hand.

## EQUIPMENT:

- Ultrasound machine with linear transducer (8–18 MHz), sterile sleeve, and gel
- Standard nerve block tray
- Local anesthetic
- 5-cm, 22-gauge, short-bevel, insulated stimulating needle
- Peripheral nerve stimulator
- Sterile gloves

## LANDMARK AND POSITIONING:

Performed with the patient in the supine, semi-sitting, or slight lateral position, with the patient's head turned away from the side to be blocked. When possible, asking the patient to reach for the ipsilateral knee will depress the clavicle slightly and allow better access to the structures of the anterolateral neck.

## GOAL:

The goal of this block is to place the needle within the plexus sheath posterior to the subclavian artery and inject local anesthetic to surround the trunks and divisions of the plexus.

## TECHNIQUE:

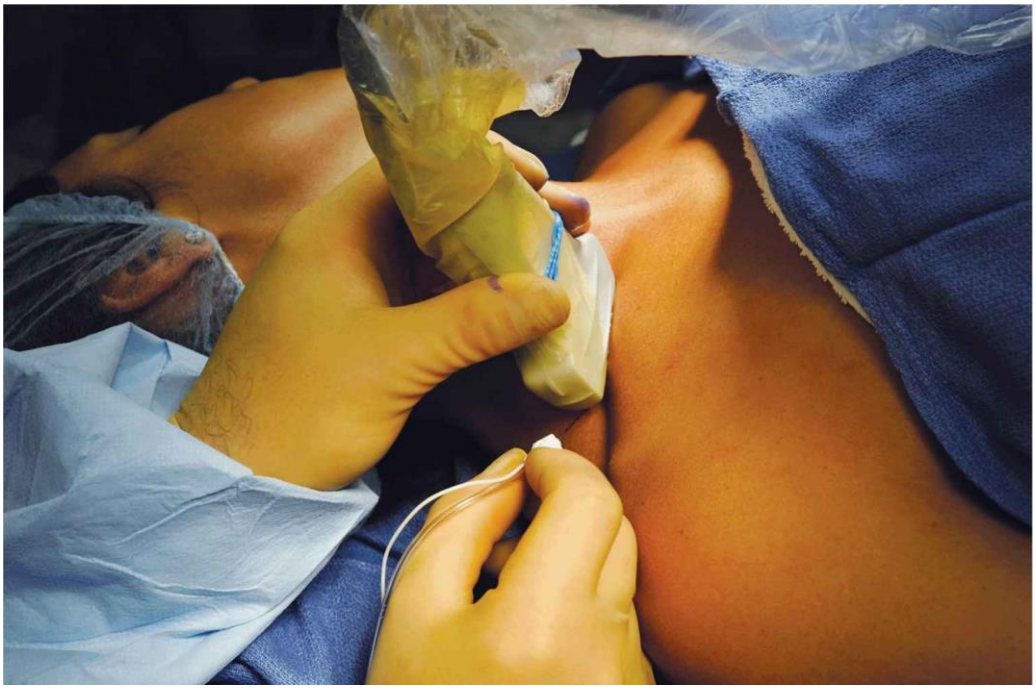


Fig no 20: Transducer placement

With the patient in the proper position, the skin is disinfected and the transducer is positioned in the transverse plane immediately superior to the clavicle at approximately its midpoint. The transducer is tilted caudally to obtain a cross-sectional view of the subclavian artery. The brachial plexus is seen as a collection of hypoechoic oval structures lateral and superficial to the artery. Using a 25- to 27-gauge needle, 1 to 2 mL of local anesthetic is injected

into the skin 1 cm lateral to the transducer to decrease the discomfort during needle insertion.

Observe the distribution of the local anesthetic during administration by injecting small amounts of the local anesthetic as the needle advances through tissue layers.

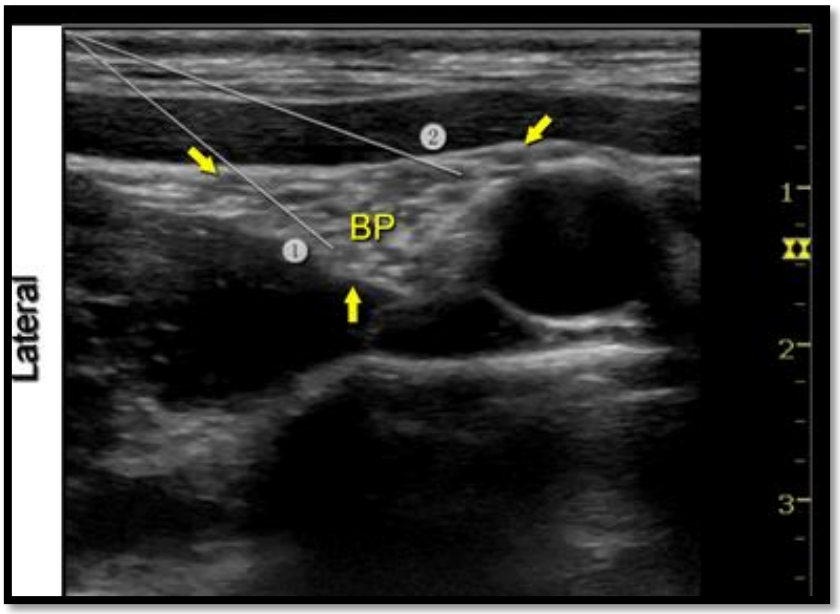



Fig no 21: Supraclavicular brachial plexus- Needle path

The block needle is then inserted in-plane toward the brachial plexus, in a lateral-to-medial direction. After a careful aspiration, 1 to 2 mL of local anesthetic is injected to document the proper needle placement. When the injection displaces the brachial plexus away from the needle, an additional advancement of the needle 1 to 2 mm deeper may be required to accomplish adequate spread of the local anesthetic.

To achieve the best possible view, the transducer must be tilted slightly inferiorly, rather than perpendicular to the skin. The goal is to see the artery as a pulsating circular structure, rather than an oval or linear structure.

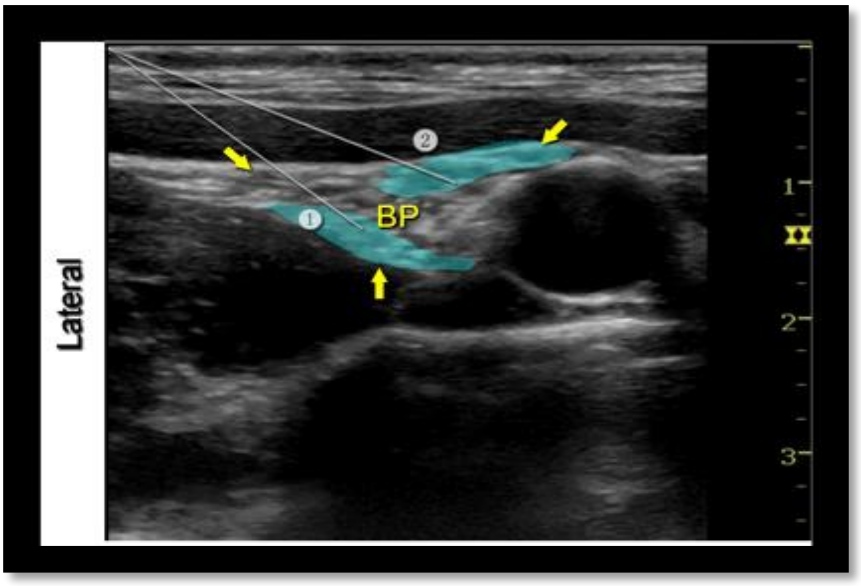
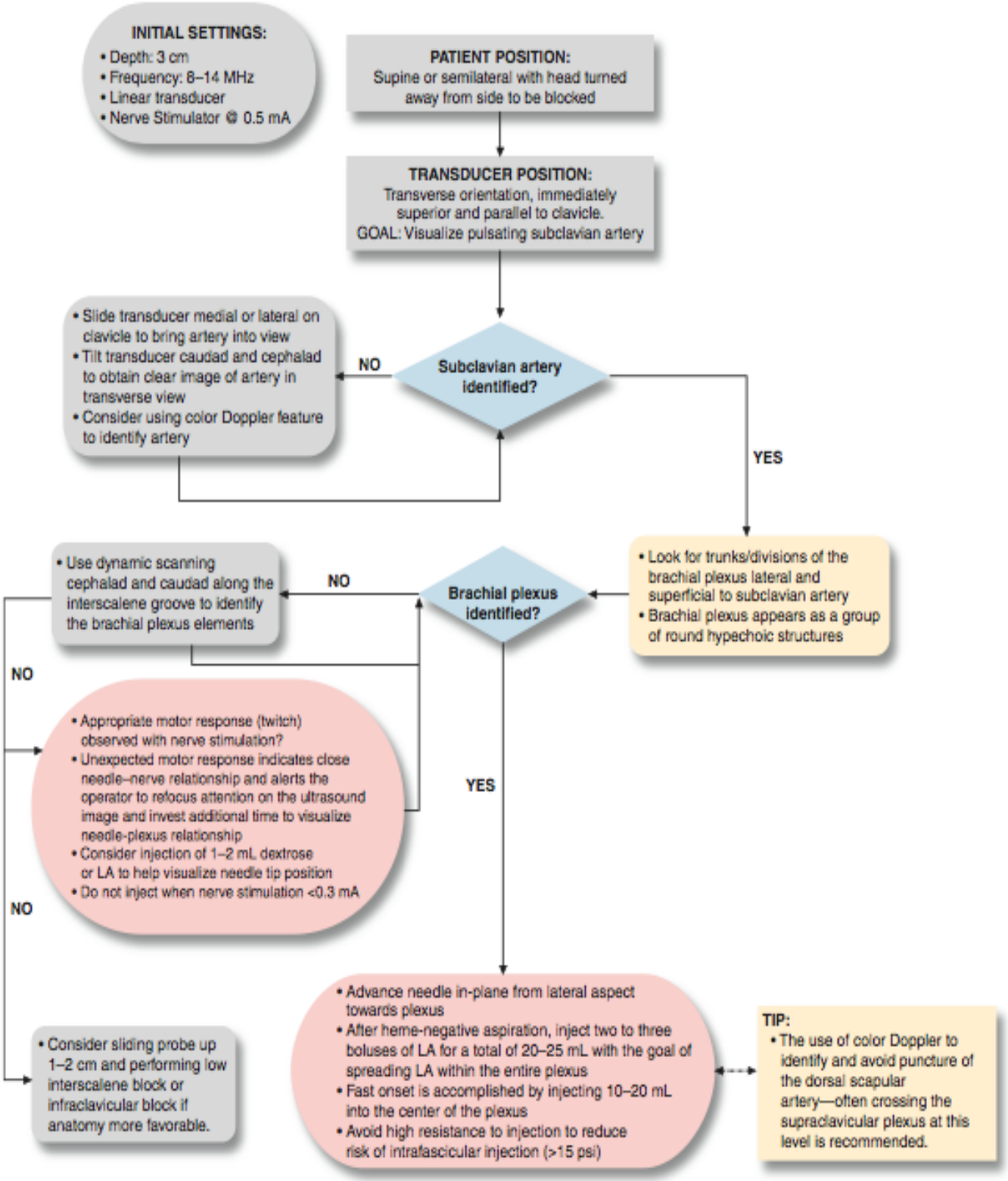



Fig no 22: Desired area of spread (blue shaded)

- A motor response to nerve stimulation is not necessary if the plexus, needle, and local anesthetic spread are well visualized.
- The neck is a highly vascular area, and care must be taken to avoid needle placement or injection into the vascular structures. Of particular importance is subclavian artery and dorsal scapular artery.
- Pneumothorax is also a rare but possible complication.
- Phrenic nerve paresis is also reported in up to 30% of patients.
- Never inject drug against resistance.

# ULTRASOUND-GUIDED SUPRACLAVICULAR BLOCK



# REVIEW OF LITERATURE

1. The study conducted by **Sidharth Sraban Routray, Debasis Mishra, Daityari Routray, and Kasturi Nanda** to study the effects of verapamil as adjuvant to levobupivacaine in supraclavicular block for upper extremity surgery. In this double-blinded clinical trial, 60 American Society of Anesthesiologist Class I and II patients posted to undergo upper extremity surgery were divided into 2 different groups randomly. In Group A, the patients received 30 ml levobupivacaine 0.5% plus 2 ml normal saline and Group B patients received 30 ml levobupivacaine 0.5% plus 5 mg verapamil diluted to 2 ml normal saline for supraclavicular block. Time of request for rescue analgesia, onset and duration of sensory motor blocks and changes in hemodynamic parameters were studied and analyzed. $P < 0.001$ was considered statistically significant. Time for a request for rescue analgesia was 425.80 ± 90.46 min in Group B and 366.13 ± 70.42 min in Group A which was clinically significant. The mean of sensory and motor block onset time in Group B was less than in Group A, the difference between the two groups being statistically significant ($P < 0.001$). In Group A, mean duration of sensory block was 316.13 ± 91.08 min and in Group B was 375.83 ± 114.48 min, which was statistically significant ($P < 0.001$). The addition of verapamil as an adjuvant to levobupivacaine in brachial plexus blockade delayed the requirement of rescue analgesia with

decreased onset time and prolonged duration of sensory and motor block characteristics.

2. The study titled Verapamil as an Adjunct to Local Anaesthetic for Brachial Plexus Blocks conducted by **Gp Capt RK Lalla, Gp Capt S Anant (Retd), Air Cmde HS Nanda.** Calcium channel blockers potentiate the effects of local anaesthetics. We examined the effect of adding verapamil to local anaesthetic solution on anaesthetic duration in patients undergoing surgery under brachial plexus block. This study was a prospective, randomized, controlled, double blind study. Sixty patients undergoing elective upper limb surgery were divided into two groups of 30 each. Group A received 40 ml of 1% lignocaine with 0.25% bupivacaine, while Group B patients had 2.5 mg verapamil added. Onset of sensory blockade time was marginally faster in Group B (23.2 ± 3.94 minutes) as compared to Group A (23.9 ± 4.13 minutes). However, this difference was statistically not significant. The increase in duration of sensory blockade in Group B (185 ± 46.52 minutes) as compared to Group A (157 ± 44.28 minutes) was statistically significant (p= 0.011). Increase in duration of motor blockade in Group B (161 ± 46.14 minutes) as compared to Group A (149 ± 42,76 minutes) was statistically not significant (p = 0.15). Similarly, prolongation of analgesic duration in Group B (318 ± 69.54minutes) as compared to Group A (302 ± 0.69 minutes) was statistically not significant (p=0.18). We conclude that

adding verapamil to brachial plexus block can prolong sensory anaesthesia without any effect on analgesic duration.

3. The study titled the effect of verapamil as an adjuvant agent with local anesthetic on sensory block level, hemodynamic and postoperative pain conducted by **Tabaeizavareh MH, Omranifard M, Moalemi A**. In this prospective randomized interventional clinical double-blind study ASA physical status, I or II male patients referred for elective lower abdominal surgery were enrolled. They randomized in group A (20cc of 0.5% bupivacaine plus 5 mg verapamil) and B (20cc of 0.5% bupivacaine plus 2cc normal saline). The sensory level block, postoperative pain, opioid consumption and vomiting and nausea and hemodynamic state was recorded and compared in two groups. Sixty-two patients were studied. Mean of the sensory level block 20 minutes after stating epidural anesthesia and immediately after surgery, postoperative pain score, opioid consumption and nausea and vomiting and fluid intake was not significantly different in two groups (P>0.05). Mean of systolic and diastolic blood pressure and pulse rate changes was not significantly different in two groups (P>0.05). Verapamil as an adjuvant with bupivacaine could not significantly increase the level of sensory block and attenuate post-operative pain and analgesic consumption and hemodynamic condition of the patients. For more accurate results it is recommended to determine the effect of different dose of verapamil in

larger sample size of the patients. Studying the effect of other Ca channel blockers would be favorable in this regard.

4. The study titled Brachial plexus anesthesia with verapamil and/or morphine conducted by **Reuben SS, Reuben JP.** Calcium channel blockers potentiate the analgesic properties of both local anesthetics and opioids. We examined the analgesic effects of administering morphine, verapamil, or its combination into the brachial plexus sheath with lidocaine in 75 patients undergoing upper extremity orthopedic surgery. All patients received brachial plexus anesthesia with 40 mL of 1.5% lidocaine and epinephrine 5 microg/mL. In addition, patients were randomized to 1 of 5 groups: Group 1 received IV saline; Group 2 received IV verapamil 2.5 mg and morphine 5 mg; Group 3 received IV verapamil 2.5 mg and morphine 5 mg was added to the lidocaine solution; Group 4 received IV morphine 5 mg and verapamil 2.5 mg was added to the lidocaine solution; and Group 5 received verapamil 2.5 mg and morphine 5 mg were added to the lidocaine solution. Postoperatively, patients rated their pain (0-10) at 1, 6, 12, and 24 h. Patients were instructed to take 1 acetaminophen 325 mg/oxycodone 5 mg tablet every 3 h whenever the pain score exceeded 3. Analgesic duration was significantly increased in those patients receiving brachial plexus blocks with morphine (Groups 3 and 5) ($P < 0.005$). The total 24 h acetaminophen/oxycodone use was also less in Groups 3 and 5 ($P <$

0. 03). Duration of anesthesia (time of abolition of pinprick response) was significantly increased in those patients receiving brachial plexus blocks with verapamil (Groups 4 and 5) (P = 0.002). We conclude that the addition of verapamil to brachial plexus block with lidocaine can prolong the duration of sensory anesthesia, but it had no effect on analgesic duration of 24 h analgesic use.

5. The study titled Evaluation of the analgesic effect of 2 doses of verapamil with bupivacaine compared with bupivacaine alone in supraclavicular brachial plexus block conducted by **Mosaffa F, Salimi A, Lahiji F, Kazemi M, Mirkheshti**. In this double blinded clinical trial, we divided 60 ASA class I and II patients who were to undergo upper extremity surgery (aged between 18-40 yrs) into 3 different groups randomly. In group I the patients received 30ml Bupivacaine 0.5% plus 2ml normal saline for injection. Group II included patients who received 30ml bupivacaine 0.5% plus 2.5mg verapamil locally and 1ml normal saline for injection. In group III the patients got 30ml bupivacaine 0.5% plus 5mg of local verapamil. All blocks were performed through a supraclavicular brachial plexus procedure, and time of initiating sensory and motor blocks and onset of complete anesthesia and also blood pressure alterations and heart rates were studied and taken into consideration. For data analysis we used SPSS 11.5 software. Our results clarified that verapamil decreased the onset time of anesthesia,

motor block and total anesthesia but there was no statistical difference between 2.5 and 5mg doses of verapamil (P>0.05). Among patients who received verapamil in the block, variation of more than 20% from baseline wasn't detected in blood pressure and heart rate. According to our findings, verapamil causes a decrease in onset times of sensory and motor block and the initiation of complete anesthesia of bupivacaine in supraclavicular block, but there were no significant differences between groups II (verapamil 2.5mg) and III (verapamil 5mg). Blood pressure and heart rate fluctuations were not more than 20% in group II and III.

6. The study conducted by **Miranda HF, Bustamante D, Kramer V, Pelissier T, Saavedra H, Paeile C, et al**. Antinociceptive effects of Ca2+ channel blockers. The antinociceptive action of four Ca2+ channel blockers, nifedipine, nimodipine, verapamil and diltiazem, was evaluated and compared to that of morphine using three algesiometric tests in mice and rats, namely, formalin, writhing and modified hot-plate test. Dose-response curves for all the drugs tested were similar and a significant dose-dependent antinociceptive action was evident in the formalin and writhing tests. However, in the hot-plate test, only nimodipine exhibited a significant analgesic effect, confirming the misleading results previously reported for this test. The findings suggest a pharmacological role of Ca2+ channel blockers in the modulation of antinociception under acute conditions. The analgesic action of Ca2+

channel blockers could be mediated by an increase in the nociceptive threshold resulting from interference with Ca2+ influx at opioid receptors, because Ca2+ influx is critical for the release of neurotransmitters and other substances implicated in nociception and inflammation. It is suggested that if a substance has a Ca2+ channel blocking effect, it should probably have some antinociceptive properties.

7. The study titled Ultrasound-guided supraclavicular approach for regional anesthesia of the brachial plexus. prospectively studied 40 patients (ASA grades I-III) undergoing surgery of the forearm and hand, to investigate the use of ultrasonic cannula guidance for supraclavicular brachial plexus block and its effect on success rate and frequency of complications. Patients were randomized into Group S (supraclavicular paravascular approach; n = 20) and Group A (axillary approach; n = 20). Ultrasonographic study of the plexus sheath was done. After visualization of the anatomy, the plexus sheath was penetrated using a 24-gauge cannula. Plexus block was performed using 30 mL bupivacaine 0.5%. Onset of sensory and motor block of the radial, ulnar, and median nerves was recorded in 10-min intervals for 1 h. Satisfactory surgical anesthesia was attained in 95% of both groups. In Group A, 25% showed an incomplete sensory block of the musculocutaneous nerve, whereas all patients in Group S had a block of this nerve. Complete sensory block of the radial, median, and ulnar nerves was attained after an average of 40 min without a significant difference

between the two groups. Because of the direct ultrasonic view of the cervical pleura, we had no cases of pneumothorax. An accidental puncture of subclavian or axillary vessels, as well as neurologic damage, was avoided in all cases. An ultrasonography-guided approach for supraclavicular block combines the safety of axillary block with the larger extent of block of the supraclavicular approach.

8. The study titled Ultrasound guidance speeds execution and improves the quality of supraclavicular block. In this prospective study, we assessed the quality, safety, and execution time of supraclavicular block of the brachial plexus using ultrasonic guidance and neurostimulation compared with a supraclavicular technique that used anatomical landmarks and neurostimulation. It was hypothesized that ultrasonic guidance would increase the proportion of successful blocks, decrease block execution time, and reduce the incidence of complications such as pneumothorax and neuropathy. Eighty patients were randomized into two groups of 40, Group US (supraclavicular block guided in real time by a two-dimensional ultrasonic image, with neurostimulator confirmation of correct needle position) and Group NS (supraclavicular block using the subclavian perivascular approach, also with neurostimulator confirmation). Blocks were performed using bupivacaine 0.5% and lidocaine 2% (1:1 vol) with epinephrine 1:200000 as the anesthetic mixture. The onset of motor and sensory block for the

musculocutaneous, median, radial, and ulnar nerves was evaluated over a 30 min period. At 30 min 95% of patients in Group US and 85% of patients in Group NS had a partial or complete sensory block of all nerve territories (P = 0.13) and 55% of patients in Group US and 65% of patients in Group NS had a complete block of all nerve territories (P = 0.25). Surgical anesthesia without supplementation was achieved in 85% of patients in Group US and 78% of patients in Group NS (P = 0.28). No patient in Group US and 8% of patients in Group NS required general anesthesia (P = 0.12). The quality of ulnar block was significantly inferior to the quality of block in other nerve territories in Group NS, but not in Group US; the quality of ulnar block was not significantly different between Groups NS and US. The block was performed in an average of 9.8 min in Group NS and 5.0 min in Group US (P = 0.0001). No major complication occurred in either group. We conclude that ultrasound-guided neurostimulator-confirmed supraclavicular block is more rapidly performed and provides a more complete block than supraclavicular block using anatomic landmarks and neurostimulator confirmation. IMPLICATIONS: Ultrasound-guided neurostimulator-confirmed supraclavicular block is more rapidly performed and provides a block of better quality than supraclavicular block using anatomic landmarks and neurostimulator confirmation.

9. The study titled Antinociceptive effects of intrathecal L-type calcium channel blockers on visceral and somatic stimuli in the rat conducted by **Hara K, Saito Y, Kirihara Y, Sakura S, Kosaka Y**. L-type calcium channels can modulate neuronal transduction in the spinal cord. However, their role in noxious information processing in animals that are physiologically intact has not been elucidated. We evaluated the effects of L-type calcium channel blockers diltiazem and verapamil on somatic and visceral nociception at the level of the spinal cord. Intrathecal catheters were inserted at the L4-5 level in Sprague-Dawley rats. The tail flick (TF) test and colorectal distension (CD) test were used to assess somatic and visceral antinociceptive effects, respectively. Motor function was assessed by posture and muscle tone in the limbs. TF latency and CD threshold were measured before and for 180 min after the intrathecal administration of verapamil (50, 100, 300, and 500 microg), diltiazem (100, 300, 500, and 1000 microg), or isotonic sodium chloride solution. The percent maximal possible effect (%MPE) was calculated by transforming response threshold in TF and CD tests. Intrathecally administered diltiazem or verapamil increased both TF latency and CD threshold in a dose-dependent fashion. Isotonic sodium chloride solution, diltiazem 100 microg, and verapamil 50 microg did not increase %MPE in either test. Diltiazem 300 or 500 microg or verapamil 300 or 500 microg significantly ($P < 0.05$) increased %MPE, with the peak effects 5 min after administration and short-duration

antinociception. %MPE was 100% until 15 min after the administration of diltiazem 1000 microg, and significant antinociception continued until 180 min in the TF test. Motor paralysis was observed after the administration of the larger dose of each drug. We demonstrated that intrathecally administered L-type calcium channel blockers diltiazem or verapamil produced both somatic and visceral antinociception and motor block dose-dependently. They examined the effects of intrathecally administered L-type calcium channel blockers diltiazem and verapamil on somatic and visceral nociception in rats. L-type calcium channel blockers produced antinociceptive effects, suggesting a possible clinical application to control pain.

10. The study conducted by **Brose WG, Gutlove DP, Luther RR, Bowersox SS, McGuire D** titled Use of intrathecal SNX-111, a novel, N-type, voltage-sensitive, calcium channel blocker, in the management of intractable brachial plexus avulsion pain. he objective was to assess the analgesic, antihyperesthesic, and anti-allodynic properties of SNX-111 in neuropathic pain. They described a patient with refractory, severe deafferentation pain successfully treated with SNX-111 in an open-label, baseline-controlled Phase I/II trial. The patient was hospitalized for treatment and observation. The patient was a 43-year-old man with intractable deafferentation pain of 23 years' duration secondary to brachial plexus avulsion. SNX-111, the first neuron-specific, N-type, voltage-sensitive calcium channel blocker developed for clinical use, was administered by continuous, constant-rate, intrathecal infusion via an indwelling cervical catheter. he primary outcome measures were the Visual Analog Scales of Pain Intensity (VASPI) and Pain Relief (VASPR). The patient experienced complete pain relief (VASPI = 0.0 cm and VASPR = 10.0 cm) with elimination of hyperesthesia and allodynia. SNX-111, administered intrathecally by continuous, constant-rate infusion, produced dose-dependent pain relief in a 43-year-old male patient with a 23-year history of intractable deafferentation and phantom limb pain secondary to brachial plexus avulsion and subsequent amputation.

Dizziness, blurred vision, and lateral-gaze nystagmus were dose-dependent side effects that resolved with decreasing dose levels. Complete pain relief was achieved in this patient without side effects after dose adjustment. We conclude that SNX-111 is a potent analgesic, antihyperesthesic, and antiallodynic agent. Controlled studies of SNX-111 in patients with malignant and nonmalignant pain syndromes are warranted and are under way.

# BACKGROUND

Ultrasound guided supraclavicular block is used for upper limb surgeries and various additives were used to prolong the duration of blockade. Additives like opioids, alpha agonists, steroids have been used along with local anaesthetics to prolong its action and it has certain side effects too. I have added verapamil as an adjuvant to supraclavicular block. I have done this prospective study to the effect of adding verapamil to local anaesthetics. This study is to evaluate the hemodynamic changes, onset of sensory and motor blockade, duration of sensory and motor blockade, post op VAS, duration of analgesia, number of rescue analgesia needed and satisfaction score.

# AIM OF THE STUDY

- **Primary aim** of this study is to find out the need of rescue analgesia in first 24 hours and number of rescue analgesia required in first 24 hours.

- Effect of sensory and motor characteristics like onset and duration were **secondary aim**.

# MATERIALS AND METHODS

- This is a prospective randomized placebo-controlled, doubled-blinded study, conducted in Government Rajaji Hospital, Madurai after approval of the Institutional Ethics Committee.
- A written informed consent was obtained from each patient after explaining the technique before inclusion in this study.
- 60 patients were included in this study.
- The patients were allocated by computer generated randomized number into two equal groups of 30 each.

**Group 1:** Patients received ultrasound guided supraclavicular brachial plexus block using 30 mL of 0.25% bupivacaine + 2ml of distilled water.

**Group 2:** patients received ultrasound guided supraclavicular brachial plexus block 30 mL of 0.25% bupivacaine mixed with 5mg of Verapamil (dilute it as 2ml).

## Inclusion criteria:

- Patients undergoing upper limb surgeries
- ASA 1 and 2
- Age- 18 to 65 years
- Both sexes

## Exclusion criteria:

- ASA 3 and 4
- Patient refusal
- Allergic to local anaesthetics
- Coagulation disorder
- Severe Renal, Hepatic and Neurologic disorders
- Infection or inflammation at the site of injection
- Uncontrolled Diabetes mellitus
- Circulatory instability patients
- Patient on verapamil

# ANAESTHESIA TECHNIQUE

- In the operation theatre, all the patients were secured with 18 G IV line and started with IV fluids.
- Pulse rate, Blood Pressure, SpO2, ECG were recorded continuously (before and after block).
- Techniques of block were described earlier in this chapter.

## SENSORY BLOCKADE ASSESSMENT:

- Sensory characteristics of the block were assessed using response to pinprick to 23-gauge hypodermic needle.
- Patients were pinpricked at every minute to assess for sensory blockade.
- To test the radial nerve, the dorsal surface of the thumb was used.
- Palmar surfaces of the index finger for median nerve
- Little finger for ulnar nerve.

**HOLLMEN SCALE:**

1-Normal sensation to pinprick.

2-Pinprick felt as sharp pointed but weaker with the same area in another limb.

3-Pinprick recognized as touch with blunt object.

4-No response to pinprick

## MOTOR BLOCKADE ASSESSMENT:

- Thumb abduction was evaluated for the radial nerve
- Thumb adduction for the ulnar nerve
- Thumb opposition for the median nerve
- Flexion of elbow for the musculocutaneous nerve
- Modified Lovett rating scale was used for assessing motor block, ranging from 6 (usual muscular force) to 0 (complete paralysis)

**LOVETT RATING SCALE:**

0-Complete paralysis

1-Almost complete paralysis.

2-Pronounced mobility impairment

3-Slightly impaired mobility.

4-Pronounced reduction of muscular force

5- Slightly reduced muscular force.

6-Normal muscular force.

- ❖ Surgery started at sensory block scale-3.

**ONSET OF SENSORY BLOCKADE:**

- ❖ The time of onset of sensory block was defined as the interval between the injection of drug to Hollmen sensory scale 2.

**DURATION OF SENSORY BLOCKADE:**

- ❖ The duration of the sensory block was defined as the time interval between the complete sensory block and the return of normal sensation.

**ONSET OF MOTOR BLOCKADE:**

- ❖ The onset time of motor block was defined as the time between the completion of the local anesthetic injection and complete paralysis.

**DURATION OF MOTOR BLOCKADE:**

- ❖ The duration of motor block was defined as the time interval between the complete paralysis and complete recovery of motor function.
- ❖ The time to first analgesic use and total dose of analgesics needed were recorded during the first 24 h.

**EVALUATION OF PAIN:**

- ❖ Pain was evaluated using the visual analog scale (VAS) where zero represented no pain and 1–3 mild pain, 4–7 moderate pain, and 8– 10- severe pain.

- ❖ VAS monitored at 2 h, 4 h, 6 h, 8 h, 10 h, 12 h, 18 h, 24 h after surgery.

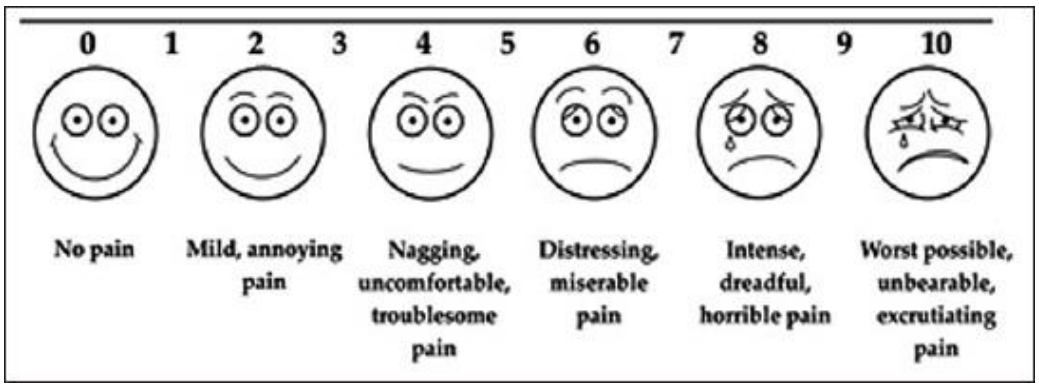



Fig no 23: VAS score

- If VAS values were >4, it was considered that analgesic action of the drugs was terminated and rescue analgesic (iv paracetamol 1 g) given. Time for the first dose of rescue analgesia was noted.
- PR, SBP, and DBP were monitored at every 15 min interval up to 2 h and then at 4 h, 8 h, 12 h, and at 24 h.
- The level of sedation was assessed by Ramsay sedation scale.

## Ramsay Sedation Score

| | |
|---|---|
| Level 1 | Awake, anxious, agitated, restlessness |
| Level 2 | Awake, cooperative, tranquil. |
| Level 3 | Respond to commands. |
| Level 4 | Asleep, brisk response to stimuli. |
| Level 5 | Asleep, sluggish response to stimuli. |
| Level 6 | Asleep, no response |

Table no 3: Ramsay sedation score

**SIDE EFFECTS:**

- The possible side-effects such as drowsiness, pruritus, nausea/vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression, bradycardia, hypotension, and hypoxemia were noted.
- In the circumstance of inadequate or patchy block, the block was supplemented with general anesthesia.

# STATISTICAL ANALYSIS

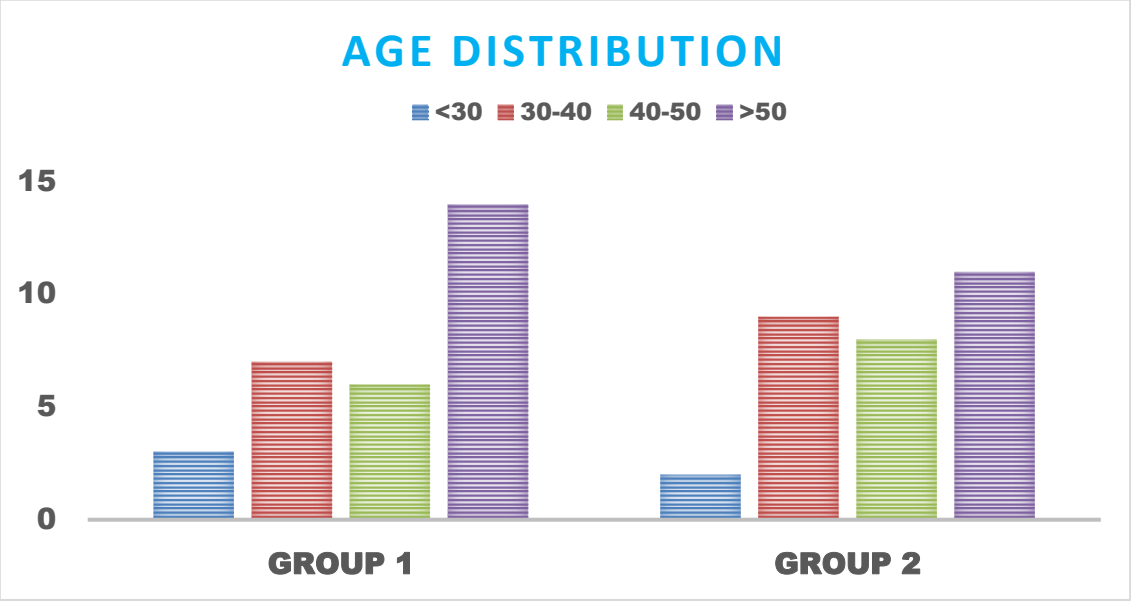
- Based on the primary aim time needed to first rescue analgesia, with α error 0.05 and power of the study (1−β) =80%, sample size was calculated to be 28.
- The patient data and block characteristics like the time of onset and duration of block were categorized and entered in excel sheet.
- The data were analyzed by chi square test and student unpaired t test
- Results were statistically analyzed by SPSS 20 software.
- $P < 0.05$ was considered as statistically significant and $P < 0.001$ as statistically highly significant.

# OBSERVATION

Table 4

## Age distribution

| AGE (YRS) | GROUP 1 | GROUP 2 |
|---|---|---|
| <30 | 3 | 2 |
| 30-40 | 7 | 9 |
| 40-50 | 6 | 8 |
| >50 | 14 | 11 |
| TOTAL | 30 | 30 |
| MEAN | 46.9 | 46.23 |
| SD | 11.24 | 12.23 |
| P | 0.8259 (Not Significant) | |




**INFERENCE:** Both the groups were comparable in age distribution

## Table 5

## SEX DISTRIBUTION

| SEX | GROUP 1 | GROUP 2 |
|---|---|---|
| MALE | 16 | 15 |
| FEMALE | 14 | 15 |
| TOTAL | 30 | 30 |

**INFERENCE:** Both the groups were comparable in sex distribution

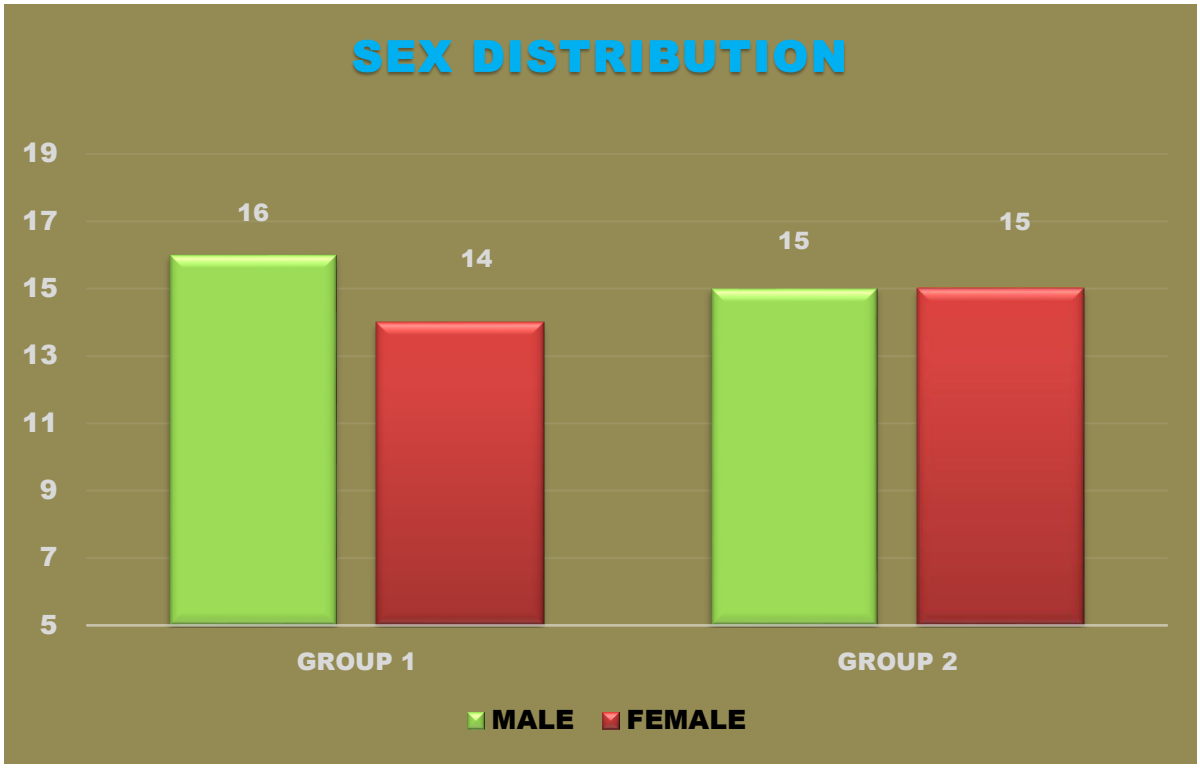
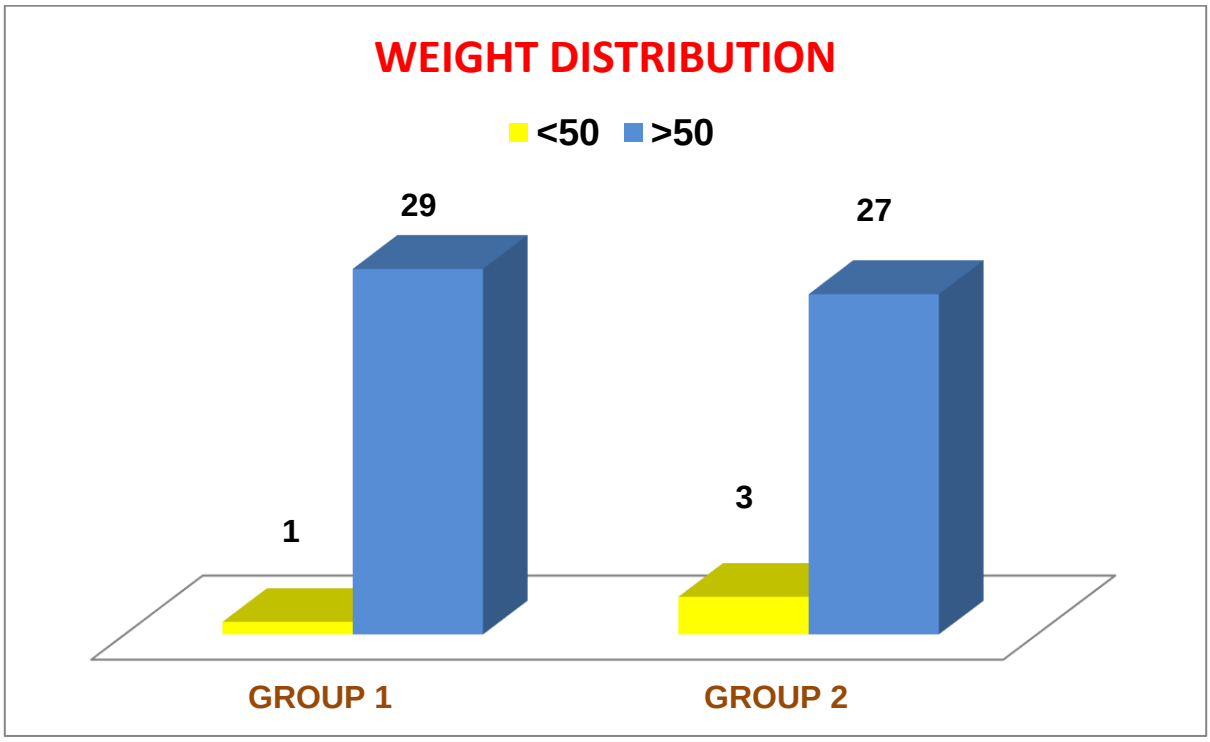


**Table 6**

## WEIGHT DISTRIBUTION

| WEIGHT(KGS) | GROUP 1 | GROUP 2 |
|---|---|---|
| <50 | 1 | 3 |
| >50 | 29 | 27 |
| TOTAL | 30 | 30 |
| MEAN | 60.27 | 61.9 |
| SD | 5.35 | 7.98 |
| **P** | **0.3566 NOT SIGNIFICANT** | |

**INFERENCE:** Both the groups were comparable in weight distribution

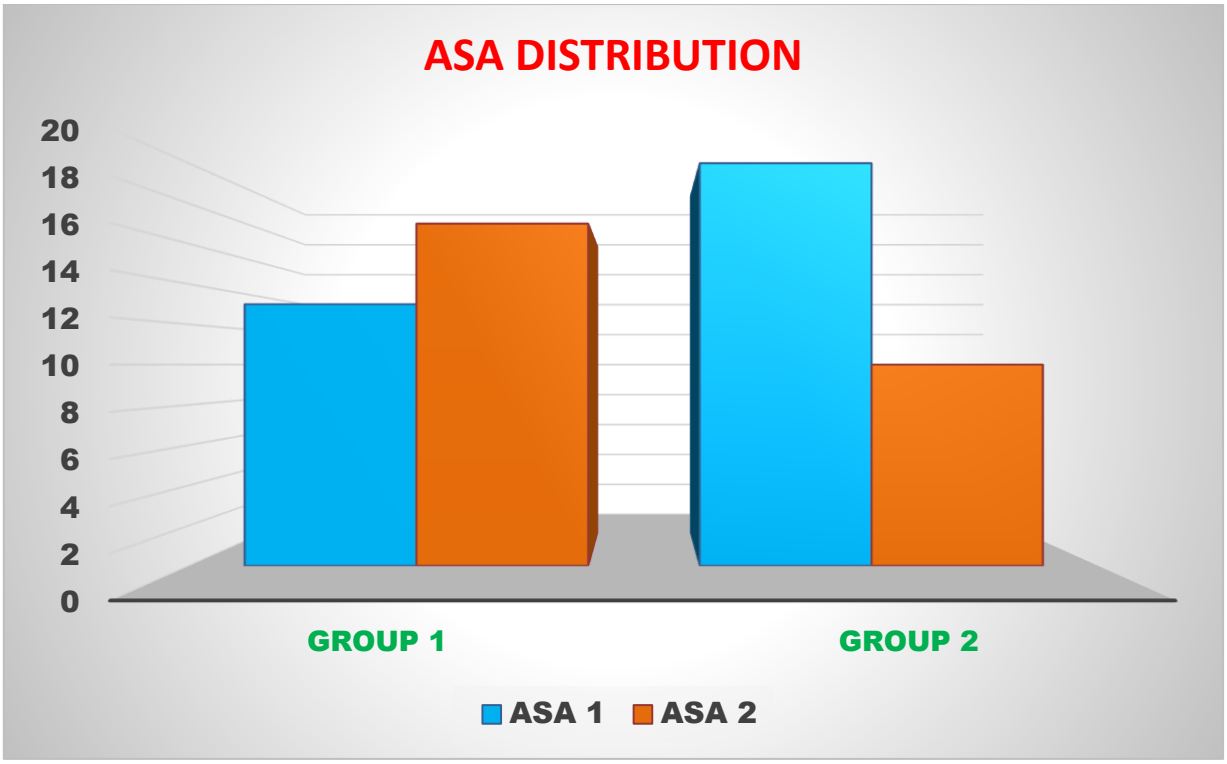


## Table 7

## ASA DISTRIBUTION

| ASA | GROUP 1 | GROUP 2 |
|---|---|---|
| 1 | 13 | 20 |
| 2 | 17 | 10 |
| TOTAL | 30 | 30 |

**INFERENCE:** Both the groups were comparable in ASA distribution



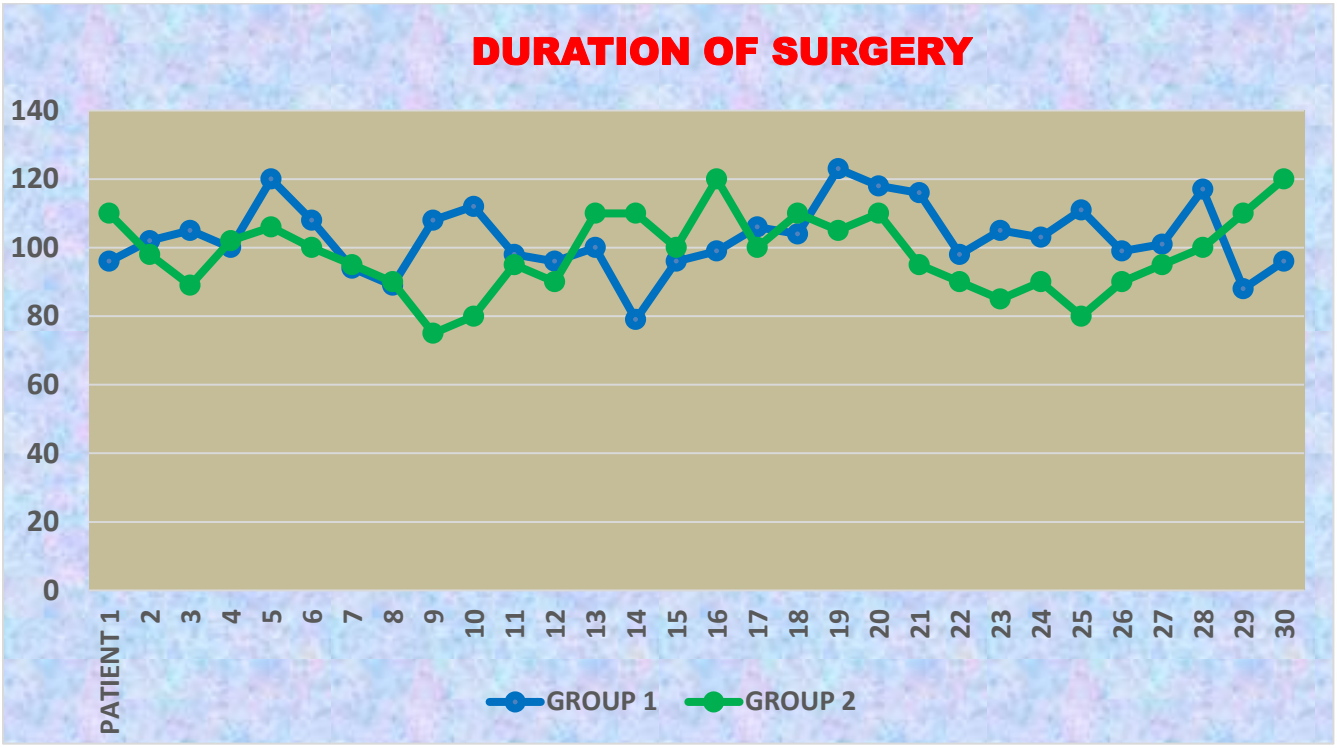
## TABLE 8

## DURATION OF SURGERY

| DURATION (MINS) | GROUP 1 | GROUP 2 |
|---|---|---|
| <90 | 3 | 9 |
| 90-100 | 10 | 10 |
| >100 | 17 | 11 |
| TOTAL | 30 | 30 |
| MEAN | 102.9 | 98.33 |
| SD | 9.95 | 11.38 |
| **P** | **0.1031 NOT SIGNIFICANT** | |

**INFERENCE:** Both the groups were comparable in duration of surgery

- The mean time for duration of surgery was comparable in both the Groups, for Group 1 mean duration were 102.9±9.95 minutes and for Group 2 mean duration were 98.33±11.38 minutes. P value of 0.1031 which is insignificant.


DURATION OF SURGERY
140
120
100
80
60
40
20
0
PATIENT 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
GROUP 1
GROUP 2

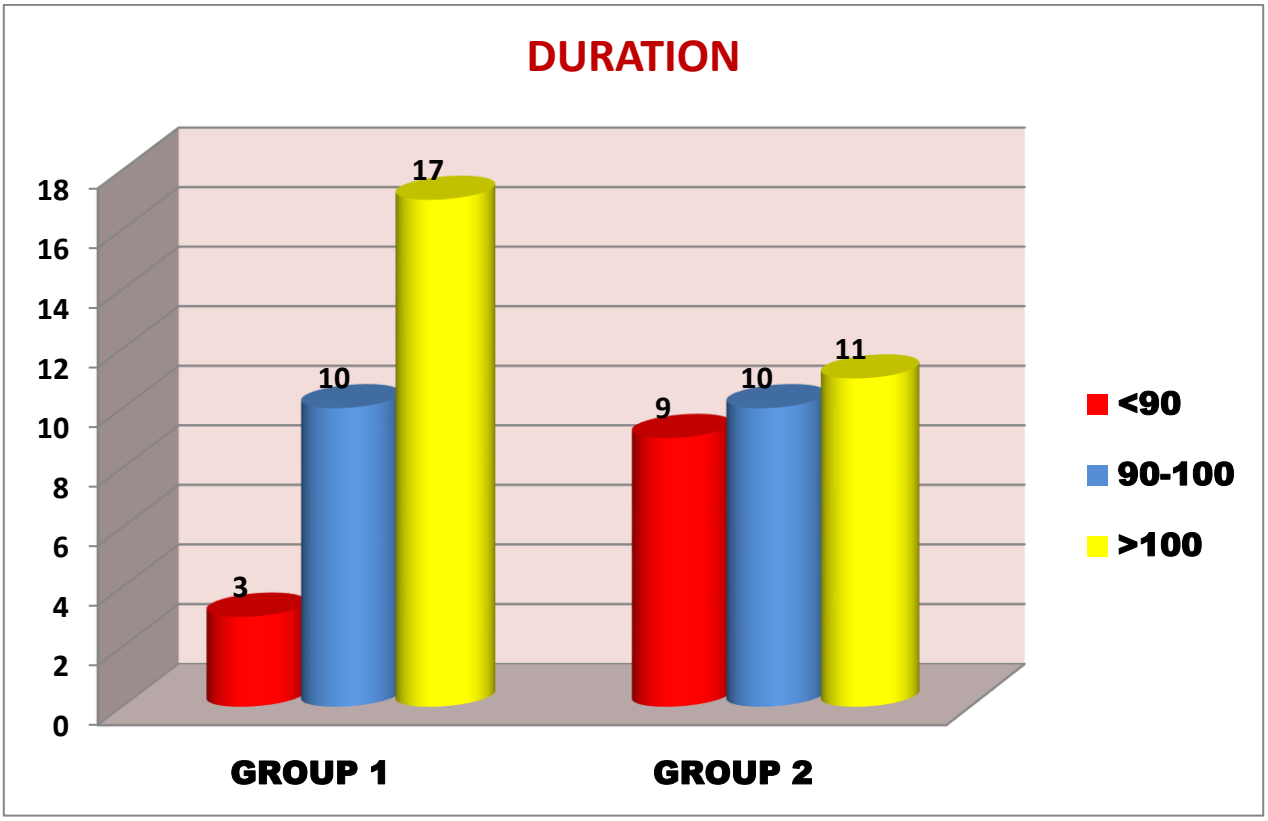

DURATION
18
16
14
12
10
8
6
4
2
0
3
10
17
9
10
11
GROUP 1
GROUP 2
<90
90-100
>100

**Table 9**

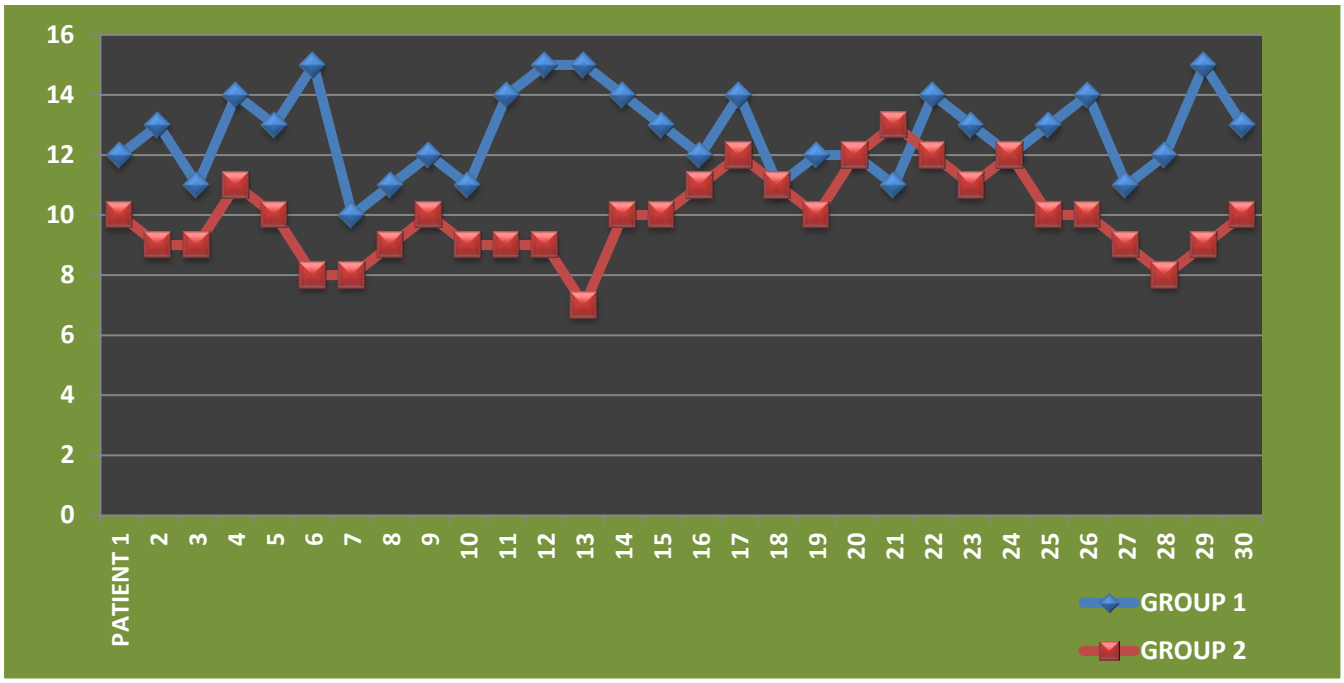
## ONSET OF SENSORY BLOCKADE

| Onset (mins) | Group 1 | Group 2 |
|---|---|---|
| <10 mins | 0 | 12 |
| >10 mins | 30 | 18 |
| TOTAL | 30 | 30 |
| MEAN | 12.73 | 9.93 |
| SD | 1.43 | 1.41 |
| **P** | **<0.0001 HIGHLY SIGNIFICANT** | |

## INFERENCE:

- The onset of sensory blockade in Group 1 was 12.73±1.43 minutes and in Group 2 were 9.93±1.41 minutes.
- The onset was faster in Group 2 compared to Group 1 with P value of <0.0001 which is highly significant.

# ONSET OF SENSORY BLOCKADE



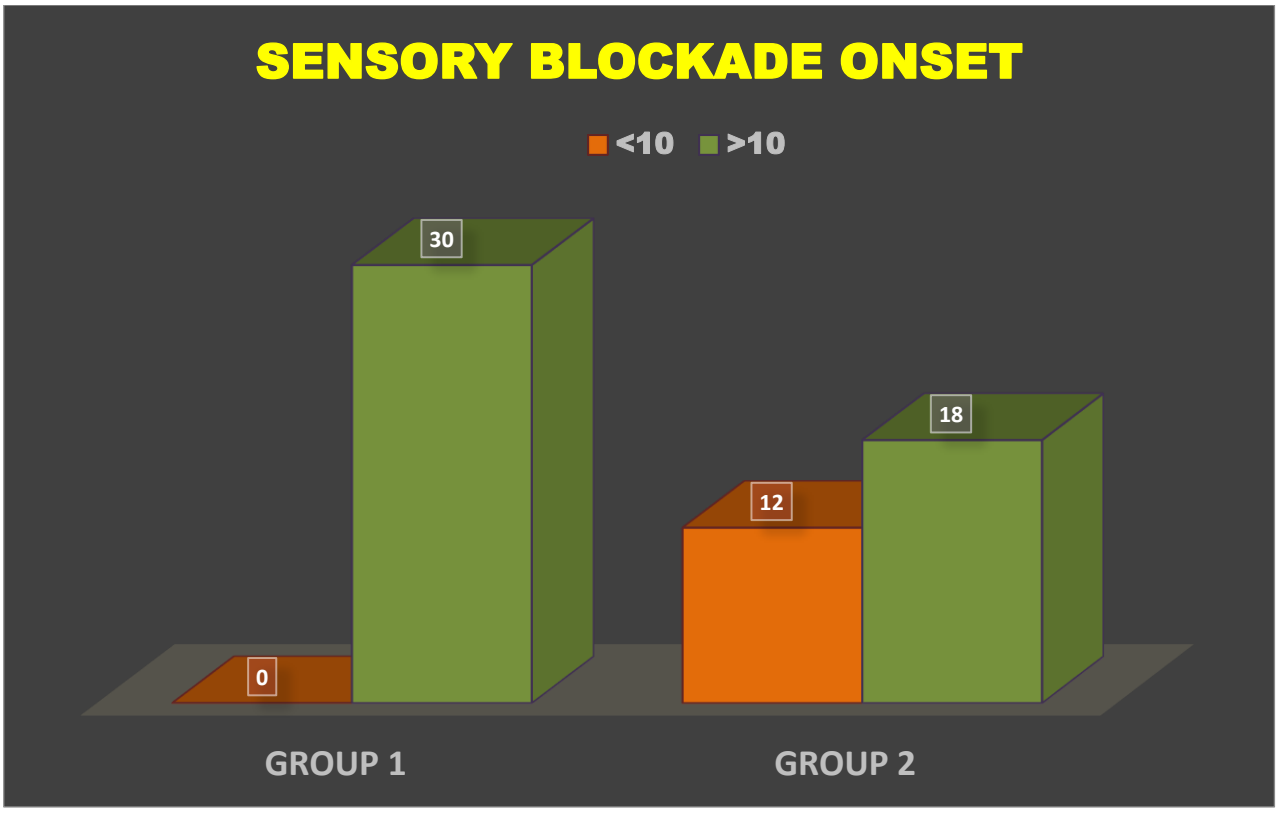



**Table 10**

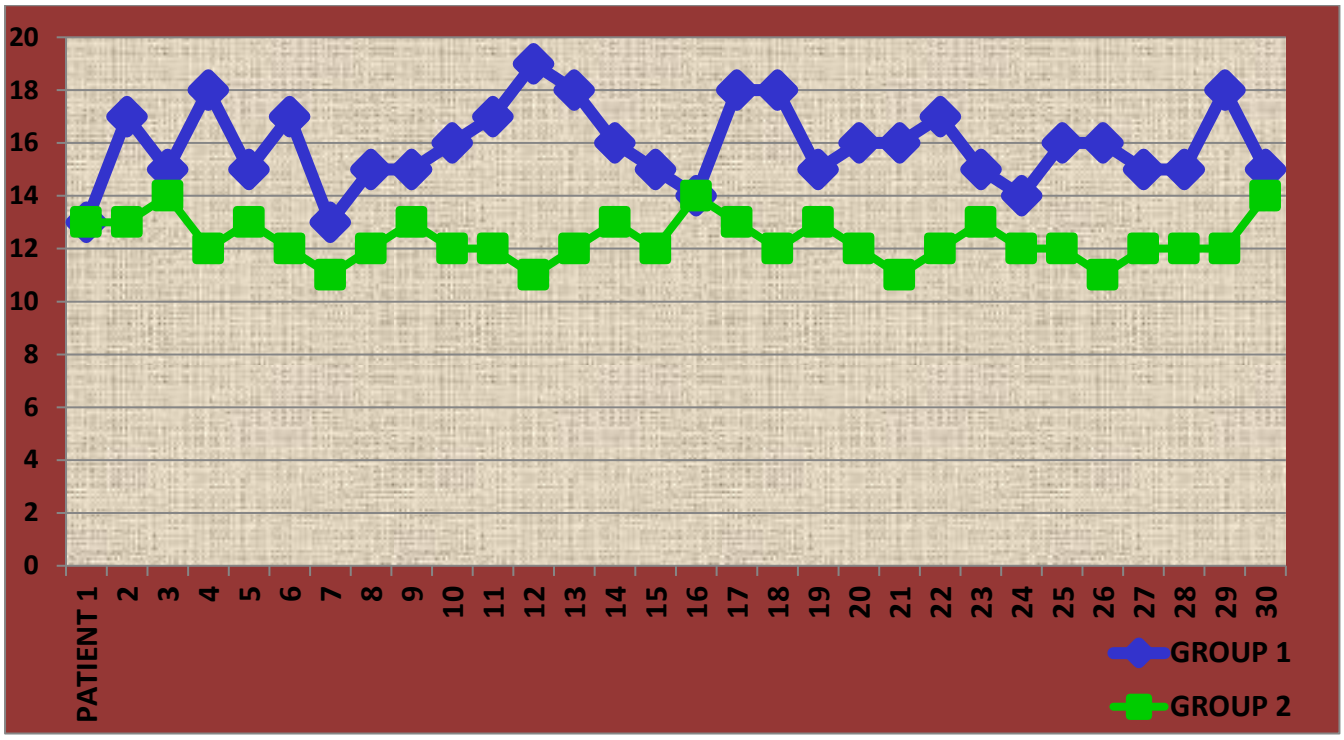
## ONSET OF MOTOR BLOCKADE

| Onset (mins) | Group 1 | Group 2 |
|---|---|---|
| <15 mins | 14 | 30 |
| >15 mins | 16 | 0 |
| TOTAL | 30 | 30 |
| MEAN | 15.9 | 12.33 |
| SD | 1.53 | 0.84 |
| **P** | **<0.0001 HIGHLY SIGNIFICANT** | |

## INFERENCE:

- The onset of motor blockade in Group 1 was 15.90±1.53 minutes and in Group 2 were 12.33±0.84 minutes.
- The onset was faster in Group 2 compared to Group 1 with P value of <0.0001 which is highly significant.

# ONSET OF MOTOR BLOCKADE



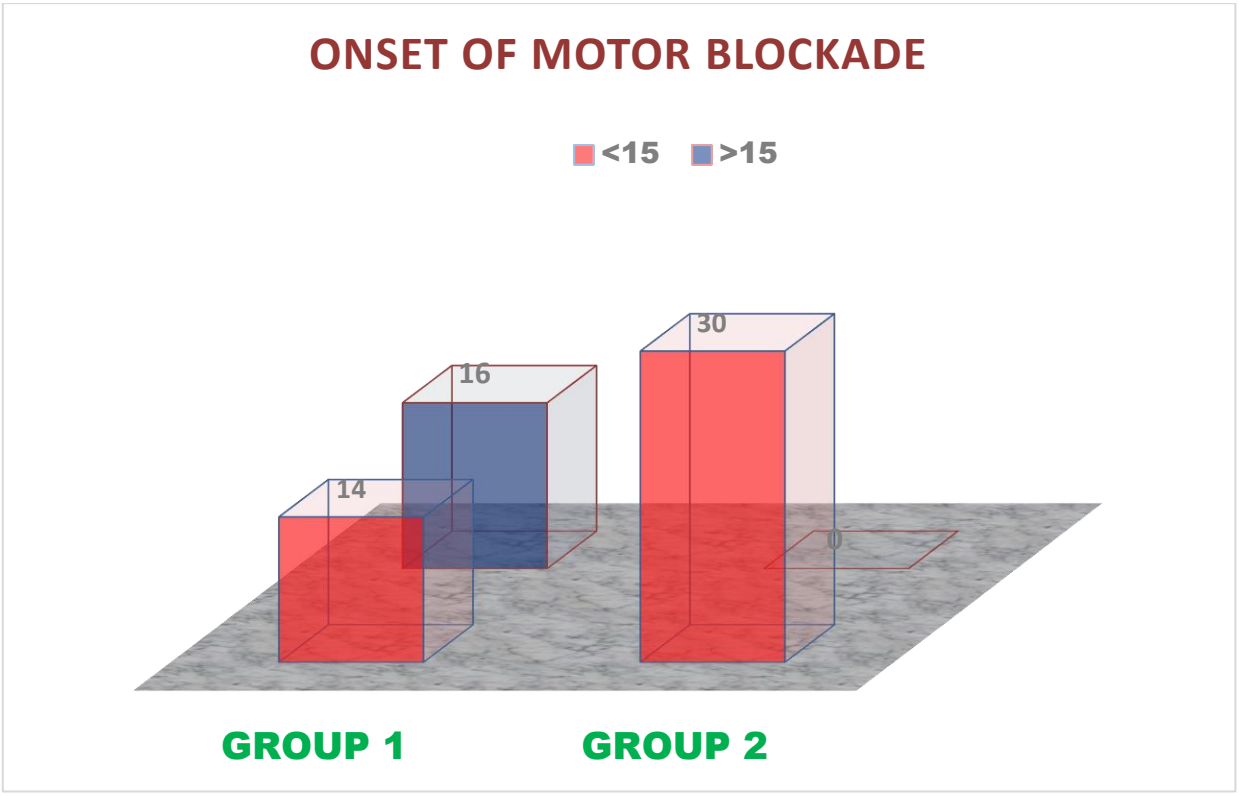



**Table 11**

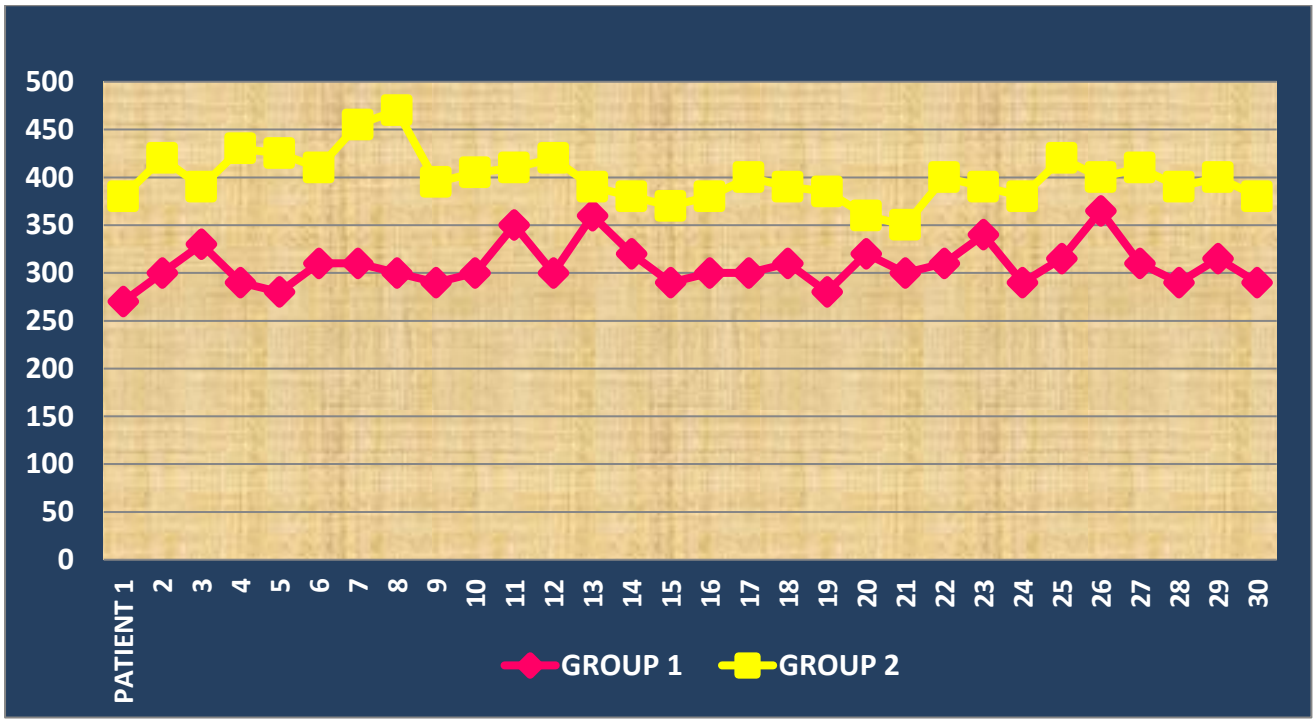
## DURATION OF SENSORY BLOCKADE

| DURATION (mins) | Group 1 | Group 2 |
|---|---|---|
| <300 | 9 | 0 |
| 300-350 | 19 | 1 |
| >350 | 2 | 29 |
| TOTAL | 30 | 30 |
| MEAN | 307.83 | 399.50 |
| SD | 22.77 | 25.40 |
| **P** | **<0.0001 HIGHLY SIGNIFICANT** | |

## INFERENCE:

- The duration of sensory blockade in Group 1 was 307.83±22.77 minutes and in Group 2 were 399.50±25.40 minutes.
- The duration was longer in Group 2 compared to Group 1 with P value of <0.0001 which is highly significant.

# DURATION OF SENSORY BLOCKADE



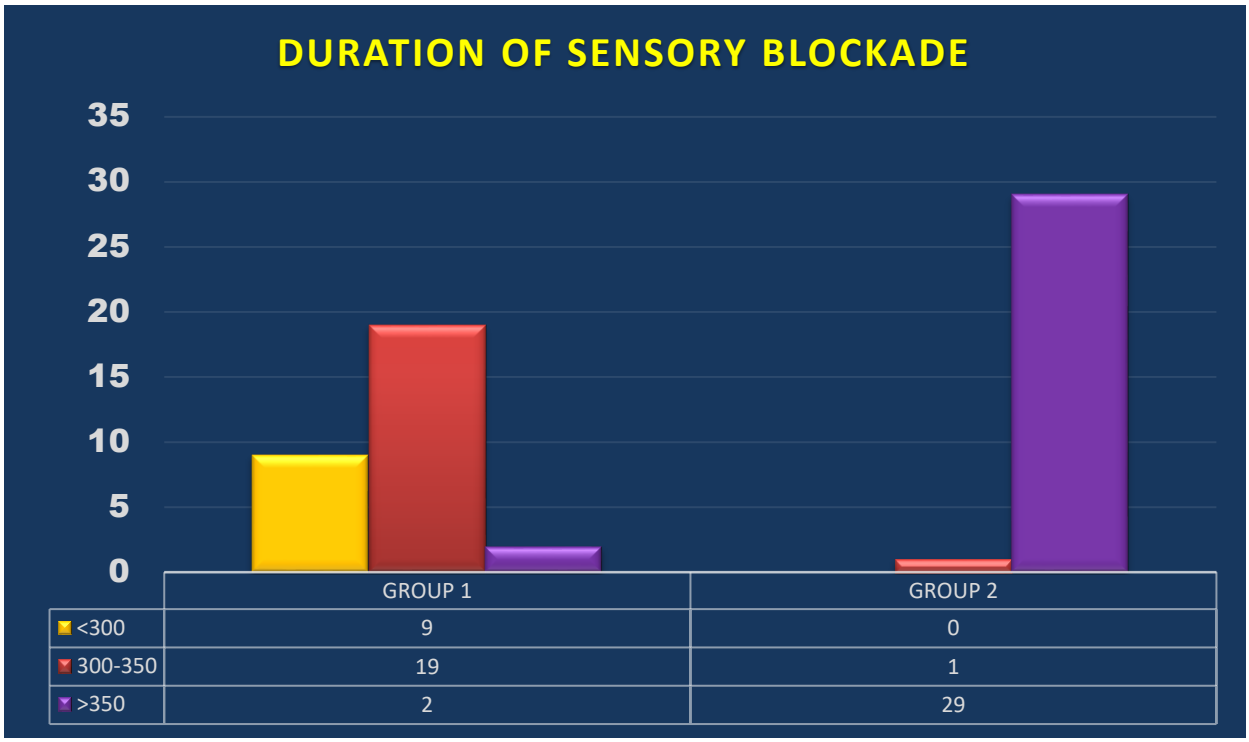



**Table 12**

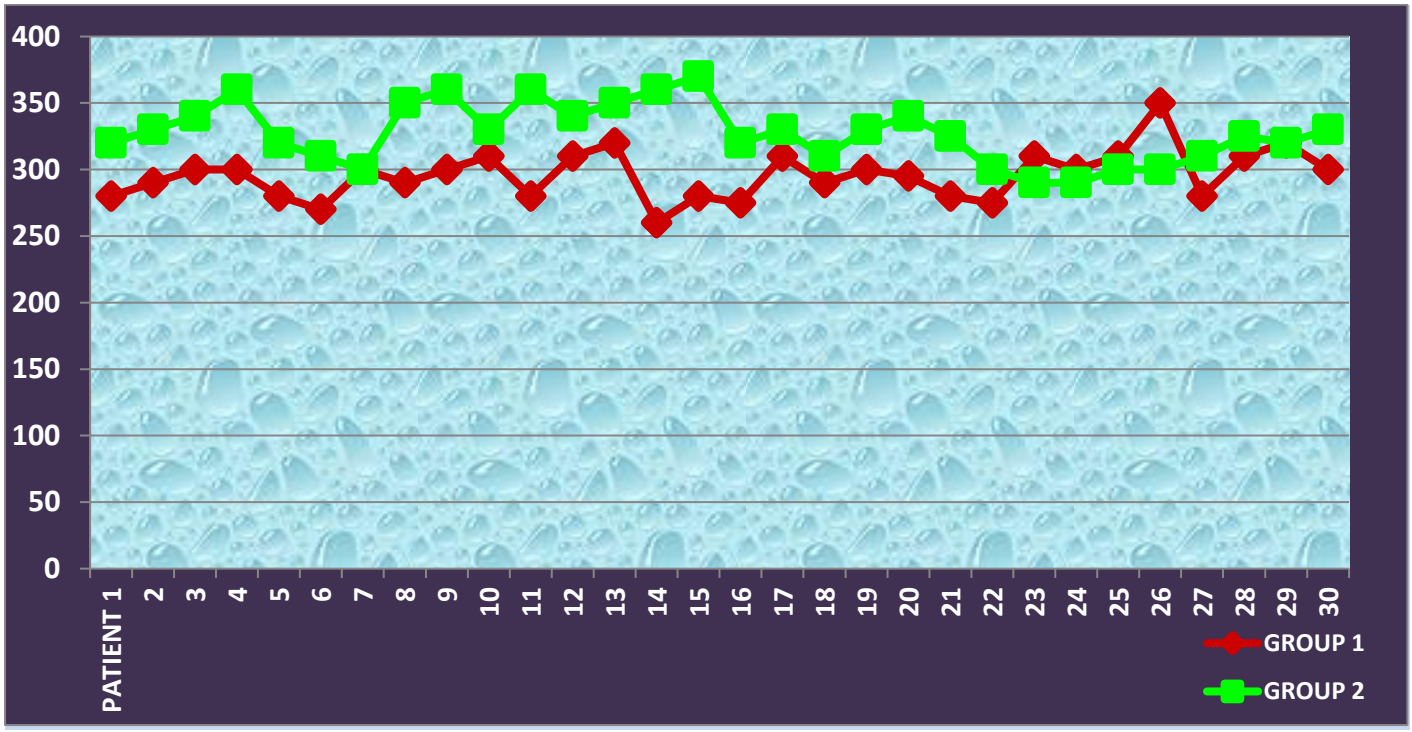
## DURATION OF MOTOR BLOCKADE

| DURATION (mins) | Group 1 | Group 2 |
|---|---|---|
| <300 | 14 | 2 |
| 300-350 | 14 | 21 |
| >350 | 2 | 7 |
| TOTAL | 30 | 30 |
| MEAN | 295.8 | 327.33 |
| SD | 18.43 | 22.39 |
| **P** | **<0.0001 HIGHLY SIGNIFICANT** | |

## INFERENCE:

- The duration of motor blockade in Group 1 was 295.80±18.43 minutes and in Group 2 were 327.33±22.39 minutes.
- The duration was longer in Group 2 compared to Group 1 with P value of <0.0001 which is highly significant.

## DURATION OF MOTOR BLOCKADE



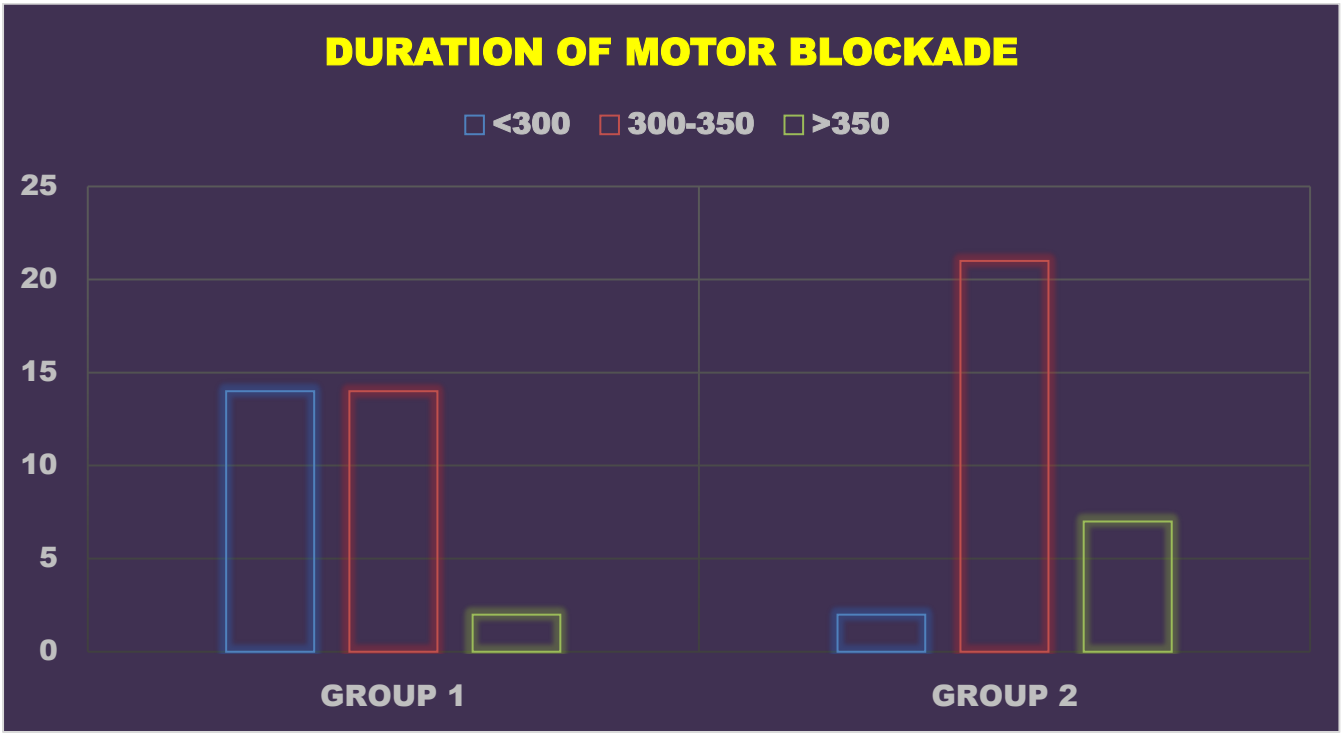



**Table 13**

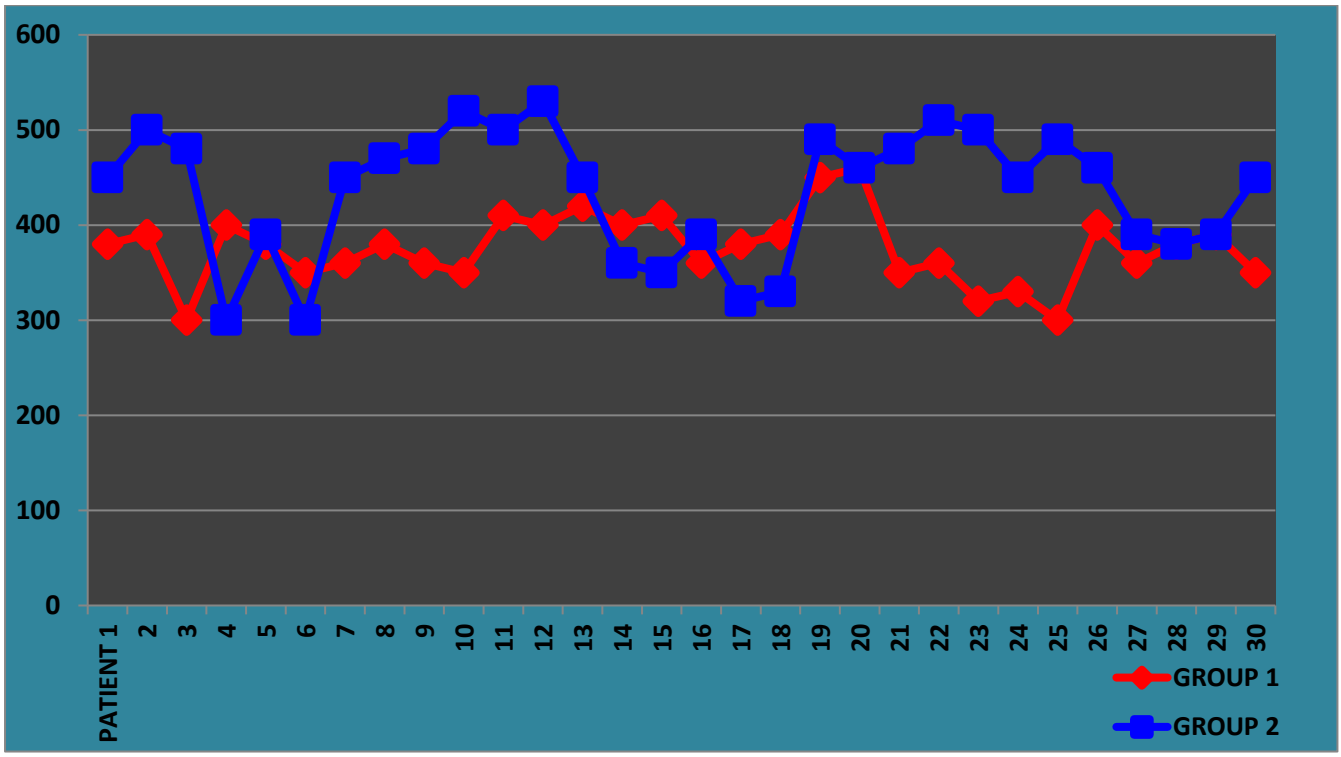
## DURATION FOR RESCUE ANALGESIA

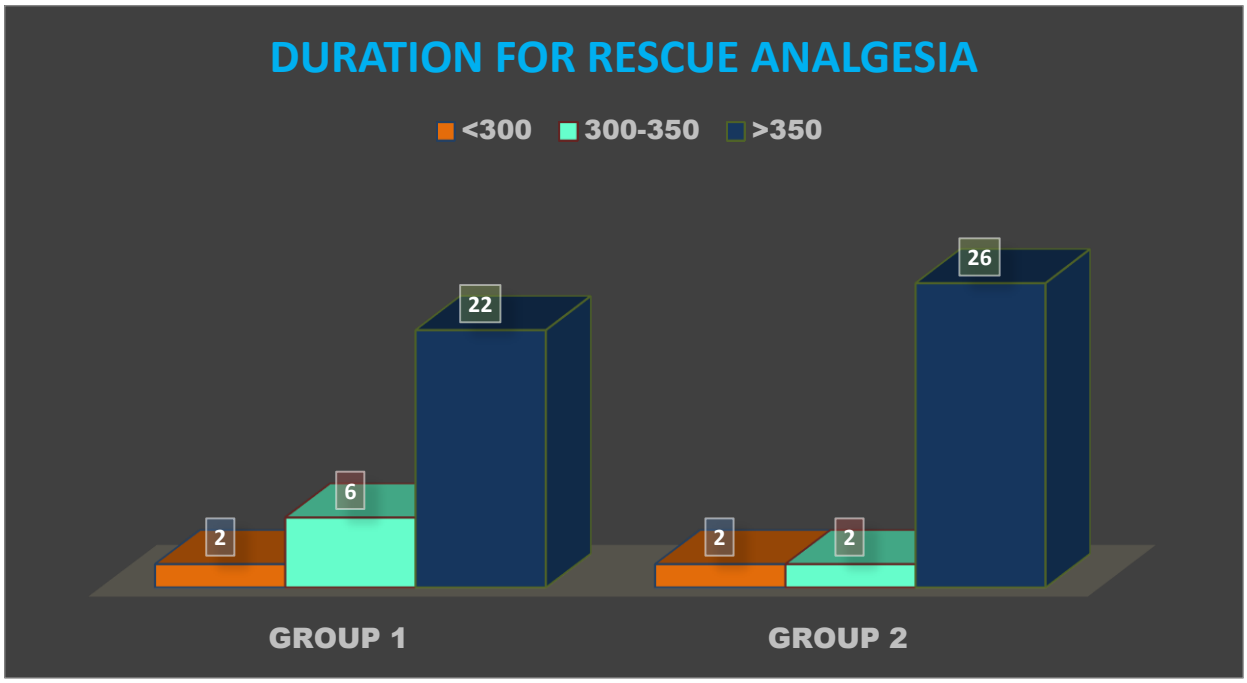
| DURATION (mins) | Group 1 | Group 2 |
|---|---|---|
| <300 | 2 | 2 |
| 300-350 | 6 | 2 |
| >350 | 22 | 26 |
| TOTAL | 30 | 30 |
| MEAN | 375.80 | 434.06 |
| SD | 37.38 | 68.20 |
| **P** | **<0.0001 HIGHLY SIGNIFICANT** | |

## INFERENCE:

- The duration for rescue analgesia in Group 1 was 375.80±37.38 minutes and in Group 2 were 434.06±68.20 minutes.
- The duration for rescue analgesia was longer in Group 2 compared to Group with P value of <0.0001 which is highly significant.

# DURATION FOR RESCUE ANALGESIA

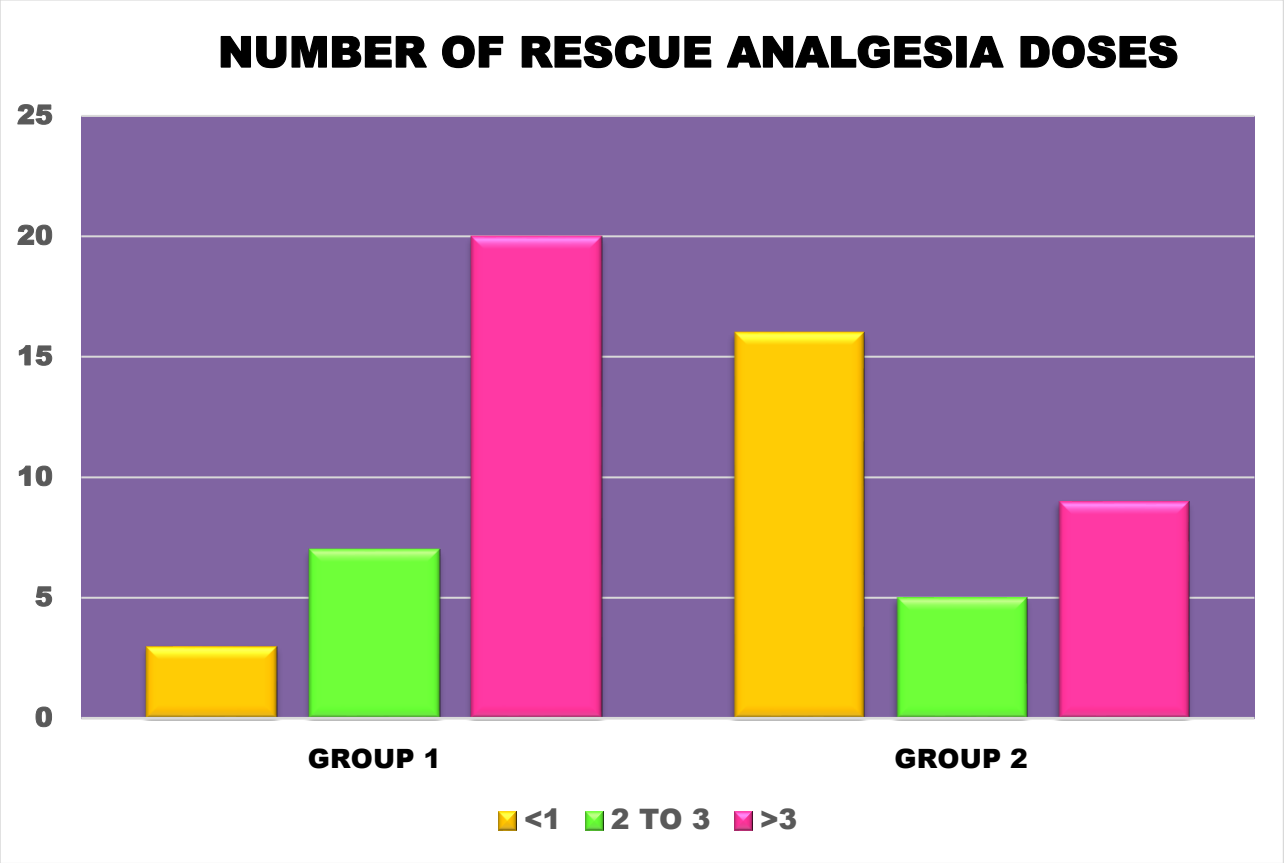


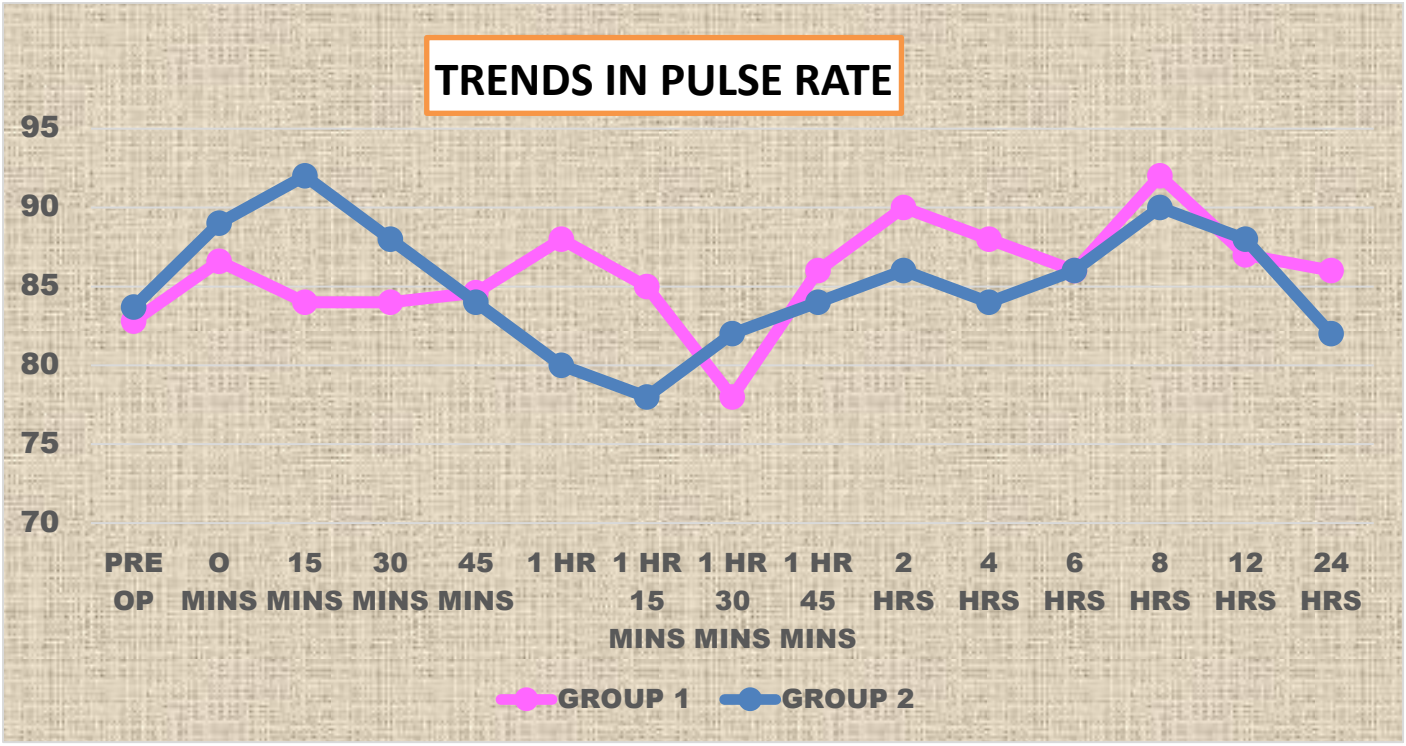
## Table 14

## NUMBER OF RESCUE ANALGESIA DOSES

| DOSES | GROUP 1 | GROUP 2 |
|---|---|---|
| ≤ 1 | 3 | 16 |
| 2-3 | 7 | 5 |
| >3 | 20 | 9 |
| TOTAL | 30 | 30 |



# PULSE RATE


TRENDS IN PULSE RATE
95
90
85
80
75
70
PRE OP
O MINS
15 MINS
30 MINS
45 MINS
1 HR
1 HR 15 MINS
1 HR 30 MINS
1 HR 45 MINS
2 HRS
4 HRS
6 HRS
8 HRS
12 HRS
24 HRS
GROUP 1
GROUP 2

## TRENDS IN SPO2

# RESULTS

- Block was successful in all patients and all the enrolled patients completed the study.
- The two groups were similar in terms of age, sex, weight, type of surgery and duration of surgery and patient satisfaction.
- Pulse rate, systolic blood pressure, diastolic blood pressure and SPO2 were similar in both the groups.

**ONSET OF SENSORY BLOCKADE:**

- Onset of sensory blockade was faster in Group 2 (9.93±1.41 mins) than Group 1 (12.73±1.43 mins) with the P value of less than 0.0001 which is statistically highly significant.

**ONSET OF MOTOR BLOCKADE:**

- Onset of motor blockade was faster in Group 2 (12.33±0.84 mins) than Group 1 (15.90±1.53 mins) with the P value of less than 0.0001 which is statistically highly significant.

**DURATION OF SENSORY BLOCKADE:**

- Duration of sensory blockade was longer in Group 2 (399.50±25.40 mins) than Group 1 (307.83±22.77 mins) with the P value of less than 0.0001 which is statistically highly significant.

**DURATION OF MOTOR BLOCKADE:**

- Duration of motor blockade was longer in group 2 (327.33±22.39 mins) than Group 1 (295.80±18.43 mins) with the P value of less than 0.0001 which is statistically highly significant.

**TIME REQUIRED FOR RESCUE ANALGESIA:**

- The time required for the first rescue analgesia was longer in Group 2 (434.06±68.20 mins) than the Group 1 (375.80±37.38 mins) with P value of less than 0.0001 which is statistically highly significant.

**NUMBER OF RESCUE ANALGESIA NEEDED IN FIRST 24 HRS**

- In Group 1 - 3 patients required 1 dose of rescue analgesia, 7 patients required 2 or 3 doses of rescue analgesia and 20 patients required more than 3 doses of rescue analgesia.
- In Group 2- 16 patients required 1 dose of rescue analgesia, 5 patients required 2 or 3 doses of rescue analgesia and 9 patients required more than 3 doses of rescue analgesia.
- The difference in both groups were statistically highly significant.

- There was no failed block or patchy block noted.
- Qualities of the operating condition were excellent in both the groups.
- No untoward events happened during intra operative or post-operative period, such as drowsiness, pruritus, nausea/vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression, bradycardia, hypotension, and hypoxemia.
- Level of sedation was comparable in both the groups. Verapamil has no sedative effects. All the patients were awake, cooperative and tranquil throughout the intra operative period.

# DISCUSSION

- Verapamil, a synthetic papaverine derivative is an L type of calcium channel blocker.
- Verapamil induces fast sodium channel blocking effects similar to local anaesthetics.
- Substance P that stimulates C fibers, can activate the neurokinin I receptor and creates slow and long depolarization and aggregate calcium flow through calcium channels. NMDA and phospholipase C activity that subsequently release calcium through the sarcoplasmic reticulum. Increase of intracellular calcium causes the increase of dynorphine gene explanation and central sensitivity such as wind up phenomenon and augments longer efficacy. So, for making a painful message intact the calcium channel is essential and any disturbances of calcium ion transmission can interfere with pain sensation.
- In our study we have used verapamil with bupivacaine in ultrasound guided supraclavicular brachial plexus and concluded that verapamil not only reduces the onset time but also increases the duration of sensory and motor blockade.
- Number of number analgesia required was low in Group 2 on comparing Group 1.

**ONSET OF SENSORY BLOCKADE:**

- Study conducted by **Sidharth Sraban Routray, Debasis Mishra, Daityari Routray, and Kasturi Nanda** using verapamil as adjuvant to supraclavicular block concluded that onset of sensory blockade was faster than group without adding any additives, mean time was 10.92±3.84 minutes.
- In our study the mean time for onset was 9.93±1.41 minutes. Other studies conducted by **Mosaffa et al.** and **Lalla et al.** also yielded comparable results.

**ONSET OF MOTOR BLOCKADE:**

- Study conducted by **Sidharth Sraban Routray, Debasis Mishra, Daityari Routray, and Kasturi Nanda** using verapamil as adjuvant to supraclavicular block concluded that onset of motor blockade was faster than group without adding any additives, mean time was 12.40±3.20 minutes.
- In our study the mean time was 12.33±0.84 minutes which is comparable. Other studies conducted by **Mosaffa et al** and **choe et al** demonstrated comparable results.

**DURATION OF SENSORY BLOCKADE:**

- In our study the duration of sensory blockade was 399.50±40.0 minutes which is comparable with other studies conducted by **Mosaffa et al**, **choe et al** and **sidharth et al.**

**DURATION OF MOTOR BLOCKADE:**

- In our study the duration of motor blockade was 327.33±22.39 minutes which is comparable to studies conducted by **Messeha and Eldeen, Sidharth et al** and **Tabaeizavareh *et al.***

**DURATION OF ANALGESIC EFFECTS:**

- Studies conducted by **Hasegawa and Zacny Miranda *et al*.** and **Carta *et al*.** and **Choe et al** suggested that calcium channel blockers combined with local anesthetics could increase analgesic effects which is comparable to our study.

**SIDE EFFECTS:**

- Study conducted by **Sidharth Sraban Routray, Debasis Mishra, Daityari Routray, and Kasturi Nanda** using verapamil as adjuvant to supraclavicular block concluded that it has no side effects, which is comparable to our study.

- **Mosaffa *et al*.** evaluated analgesic effect of 2 doses of verapamil with bupivacaine in supraclavicular brachial plexus block. They concluded that verapamil (both 2.5 mg and 5 mg) decreased the onset of sensory and motor block and increased the duration of analgesia which was statistically significant.

- **Kim *et al*.** opined that verapamil, when added to epidural bupivacaine, decreased the postoperative pain through central desensitization.

- **Lalla *et al*.** in his study concluded that addition of verapamil to lignocaine and bupivacaine combine increases the duration of sensory blockade which was statistically significant but onset of sensory and motor block and duration of motor block was not statistically significant.

- **Pirec *et al*.** have shown that application of morphine and N type calcium channel blockers attenuate pain mediated by A delta and C fiber mediated nociception.

# CONCLUSION

- The addition of verapamil as an adjuvant to bupivacaine for ultrasound guided supraclavicular brachial plexus block provides longer duration of sensory and motor blockade apart from its rapid onset.
- Hence the required analgesic doses are minimal.
- Being done under ultrasound guidance the risk of complications are minimal.

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## PROFORMA

**NAME:** **I.P.NO:** **ASA:**

**AGE & SEX:**

**WEIGHT:**

**DATE & TIME OF ADMISSION:** **DATE& TIME OF DISCHARGE: DIAGNOSIS:**

**PROCEDURE:**

**HISTORY:**

**CLINICAL EXAMINATION:** PR, BP, SPO2, RS, CVS, P/A and CNS

**BASIC INVESTIGATIONS:**

a) Complete Blood Count
b) Blood grouping & typing,
c) BT, CT
d) Urine routine
e) Blood urea, RBS, Serum Creatinine, Serum electrolytes
f) CXR-PA view
g) ECG, ECHO
h) USG abdomen

**ANAESTHETIC TECHNIQUE:**

Ultrasound guided supraclavicular brachial plexus block

**DOSAGE OF DRUG:**

Group 1: Patients received ultrasound guided supraclavicular brachial plexus block using 30 mL of 0.25% bupivacaine.

Group 2: patients received ultrasound guided supraclavicular brachial plexus block 30 mL of 0.25% bupivacaine mixed with 5mg of Verapamil.

**EVALUATION OF PR, BP, SPO2 TILL END OF THE PROCEDURE**

**CONTINUOUS ECG MONITORING WAS CARRIED OUT THROUGHOUT THE PROCEDURE**

**MONITORING OF VITALS EVERY 15MIN: (ANXIOLYTICS, SEDATIVES, ANTIEMETICS AND OTHERS TO BE MENTIONED)**

| VITALS | PREOP | 5MIN | 15MIN | 30MIN | 45MIN | 1HR | 1HR 15MIN | 1HR 30MIN | 2 HR |
|---|---|---|---|---|---|---|---|---|---|
| PULSE | | | | | | | | | |
| B. P | | | | | | | | | |
| SPO2 | | | | | | | | | |
| SIDE EFFECTS | | | | | | | | | |
| REMARKS | | | | | | | | | |

**DURATION OF SURGERY:**

**ANAESTHESIA RECOVERY TIME:**

**IMMEDIATE POSTOPERATIVE PAIN INTENSITY (VAS SCORE):**

**0 MEANING NO PAIN**

**10 MEANING EXCRUCIATING PAIN**

**POSTOP PERIOD: MONITORING OF VITALS**

| PARAMETERS | 30MIN | 1HR | 2HR | 4HRS | 6HRS | 8HRS | 10HRS | 12HRS | 24HRS |
|---|---|---|---|---|---|---|---|---|---|
| **PULSE** | | | | | | | | | |
| **B. P** | | | | | | | | | |
| **SPO2** | | | | | | | | | |
| **VAS SCORE** | | | | | | | | | |
| **SIDE EFFECTS** | | | | | | | | | |
| **REMARKS** | | | | | | | | | |

(SIDE EFFECTS include drowsiness, pruritus, nausea/vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression, bradycardia, hypotension, and hypoxemia.)

| Parameters | Group 1<br>Bupivacaine 0.25 % | Group 2<br>Bupivacaine 0.25% with 5mg of verapamil |
|---|---|---|
| Onset time of motor block | | |
| Duration of motor block | | |
| Onset of sensory block | | |
| Duration of sensory block | | |
| Time to first analgesic use | | |
| Total dose of analgesics | | |

## QUESTIONAIRRES USED IN THE STUDY

1) H/O Any Known allergy to Local Anaesthetics/ any drugs

2) H/O Previous Neurological deficit

3) H/O Any Bleeding diathesis

4) Any infection/Local sepsis at block site

5) H/O Any Anti-Psychiatric drugs

6) H/O Any systemic illness-Hypertension Diabetes Mellitus, Bronchial Asthma, Seizure disorder, Pulmonary Tuberculosis.

7) H/O of smoking, COPD, Exertional dyspnoea, decreased urine output (Complaints related to CVS, RS, and RENAL system).

# PLAGIARISM CERTIFICATE

This is to certify that this dissertation work titled "**ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK USING VERAPAMIL AS ADJUVANT TO LOCAL ANAESTHETIC FOR UPPER LIMB SURGERY**" of the candidate Dr.G. MANIKANDAN with registration Number **201620103** for the award of Master Degree in the branch of ANAESTHESIOLOGY.

I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows **ZERO (0%) percentage** of plagiarism in the dissertation.

Guide & Supervisor sign with Seal

| GROUP 1 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.NO | NAME | AGE | SEX | WT | ASA | DURATION OF SURGERY | PRE OP | | | ONSET SENSORY BLOCK | ONSET MOTOR BLOCK | SENSORY BLOCK DURATION | MOTOR BLOCK DURATION |
| | | | | | | | PR | BP | SPO2 | | | | |
| 1 | RAJA | 60 | M | 58 | 2 | 96 | 85 | 130/70 | 98 | 12 | 13 | 270 | 280 |
| 2 | MALAR | 42 | F | 62 | 2 | 102 | 83 | 120/80 | 99 | 13 | 17 | 300 | 290 |
| 3 | RAMA | 38 | F | 65 | 1 | 105 | 83 | 110/80 | 98 | 11 | 15 | 330 | 300 |
| 4 | UMA | 33 | F | 59 | 1 | 100 | 80 | 100/70 | 99 | 14 | 18 | 290 | 300 |
| 5 | ARUN | 35 | M | 49 | 1 | 120 | 75 | 120/70 | 97 | 13 | 15 | 280 | 280 |
| 6 | MUTHU | 48 | M | 52 | 2 | 108 | 87 | 140/70 | 99 | 15 | 17 | 310 | 270 |
| 7 | SUBRAMANI | 49 | M | 53 | 2 | 94 | 82 | 120/70 | 98 | 10 | 13 | 310 | 300 |
| 8 | RAMANI | 46 | F | 58 | 2 | 89 | 78 | 120/70 | 98 | 11 | 15 | 300 | 290 |
| 9 | VIGNESH | 27 | M | 56 | 1 | 108 | 86 | 110/70 | 99 | 12 | 15 | 290 | 300 |
| 10 | TAMILSELVI | 60 | F | 58 | 2 | 112 | 84 | 120/80 | 99 | 11 | 16 | 300 | 310 |
| 11 | KANNAN | 62 | M | 58 | 2 | 98 | 85 | 110/70 | 98 | 14 | 17 | 350 | 280 |
| 12 | KARTHIK | 33 | M | 60 | 1 | 96 | 82 | 120/70 | 99 | 15 | 19 | 300 | 310 |
| 13 | RAMYA | 39 | F | 62 | 1 | 100 | 83 | 130/70 | 98 | 15 | 18 | 360 | 320 |
| 14 | DHIVYA | 24 | F | 64 | 1 | 79 | 88 | 120/80 | 99 | 14 | 16 | 320 | 260 |
| 15 | MANIKANDAN | 29 | M | 59 | 1 | 96 | 87 | 130/70 | 99 | 13 | 15 | 290 | 280 |
| 16 | ANNAMALAI | 48 | M | 59 | 2 | 99 | 78 | 120/80 | 98 | 12 | 14 | 300 | 275 |
| 17 | MANICKAM | 52 | M | 56 | 2 | 106 | 77 | 110/80 | 99 | 14 | 18 | 300 | 310 |
| 18 | SIVAGAMI | 51 | F | 64 | 2 | 104 | 82 | 100/70 | 97 | 11 | 18 | 310 | 290 |
| 19 | LAKSHMI | 53 | F | 65 | 2 | 123 | 84 | 120/70 | 99 | 12 | 15 | 280 | 300 |
| 20 | SANTHOSH KUMAR | 56 | M | 63 | 1 | 118 | 86 | 140/70 | 98 | 12 | 16 | 320 | 295 |
| 21 | VEERAIYA | 60 | M | 62 | 2 | 116 | 88 | 120/70 | 99 | 11 | 16 | 300 | 280 |
| 22 | RAGU | 49 | M | 60 | 1 | 98 | 78 | 110/70 | 98 | 14 | 17 | 310 | 275 |
| 23 | MUTHUSAMY | 51 | M | 70 | 2 | 105 | 80 | 130/80 | 98 | 13 | 15 | 340 | 310 |
| 24 | KANAMMAL | 54 | F | 59 | 2 | 103 | 82 | 120/70 | 99 | 12 | 14 | 290 | 300 |
| 25 | REVATHI | 52 | F | 72 | 1 | 111 | 84 | 140/90 | 99 | 13 | 16 | 315 | 310 |
| 26 | SHANKAR | 39 | M | 68 | 1 | 99 | 86 | 130/90 | 99 | 14 | 16 | 365 | 350 |
| 27 | PUNITHA | 65 | F | 63 | 2 | 101 | 88 | 130/80 | 98 | 11 | 15 | 310 | 280 |
| 28 | MARIYAMMAL | 59 | F | 65 | 2 | 117 | 89 | 140/90 | 99 | 12 | 15 | 290 | 310 |
| 29 | MURUGAN | 37 | M | 59 | 1 | 88 | 78 | 130/80 | 99 | 15 | 18 | 315 | 320 |
| 30 | LEELAVATHY | 56 | F | 50 | 2 | 96 | 76 | 120/80 | 98 | 13 | 15 | 290 | 300 |

| GROUP 1 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 MINS | | 30 MIMS | | 45 MINS | | 60 MINS | | 1 HR 15 MINS | | 1 HR 30 MINS | | 1 HR 45 MINS | | 2 HRS | | 4 HRS | |
| PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP |
| 88 | 130/70 | 82 | 120/80 | 82 | 140/70 | 87 | 140/70 | 83 | 130/70 | 86 | 130/90 | 84 | 140/90 | 82 | 120/70 | 86 | 140/70 |
| 87 | 120/80 | 84 | 110/80 | 84 | 120/70 | 82 | 120/70 | 88 | 120/80 | 88 | 130/80 | 86 | 130/90 | 78 | 120/70 | 88 | 120/70 |
| 78 | 130/70 | 86 | 100/70 | 86 | 110/70 | 78 | 120/70 | 87 | 130/70 | 89 | 140/90 | 88 | 130/80 | 84 | 140/90 | 78 | 110/70 |
| 77 | 120/80 | 88 | 120/70 | 88 | 130/80 | 84 | 140/90 | 78 | 120/80 | 78 | 130/80 | 89 | 140/90 | 83 | 130/70 | 80 | 130/80 |
| 82 | 110/80 | 78 | 140/70 | 78 | 120/70 | 83 | 130/70 | 77 | 110/80 | 76 | 120/80 | 87 | 140/70 | 88 | 120/80 | 89 | 140/90 |
| 84 | 100/70 | 80 | 120/70 | 80 | 140/90 | 88 | 120/80 | 82 | 100/70 | 88 | 120/70 | 82 | 120/70 | 87 | 130/70 | 78 | 130/80 |
| 86 | 120/70 | 82 | 110/70 | 82 | 130/90 | 87 | 130/70 | 84 | 120/70 | 78 | 110/70 | 78 | 120/70 | 78 | 120/80 | 76 | 120/80 |
| 88 | 140/70 | 84 | 130/80 | 84 | 130/80 | 78 | 120/80 | 86 | 140/70 | 80 | 130/80 | 84 | 140/90 | 76 | 120/80 | 88 | 120/70 |
| 78 | 120/70 | 86 | 120/70 | 86 | 140/90 | 76 | 120/80 | 88 | 120/70 | 82 | 120/70 | 83 | 130/70 | 88 | 120/70 | 78 | 110/70 |
| 80 | 110/70 | 88 | 140/90 | 88 | 130/80 | 88 | 120/70 | 78 | 110/70 | 84 | 140/90 | 88 | 120/80 | 78 | 110/70 | 80 | 130/80 |
| 82 | 130/80 | 89 | 130/90 | 89 | 120/80 | 78 | 110/70 | 80 | 130/80 | 86 | 130/90 | 87 | 130/70 | 80 | 130/80 | 82 | 120/70 |
| 84 | 120/70 | 78 | 130/80 | 78 | 120/70 | 80 | 130/80 | 82 | 120/70 | 88 | 130/80 | 78 | 120/80 | 82 | 120/70 | 84 | 140/90 |
| 86 | 140/90 | 76 | 140/90 | 76 | 110/70 | 82 | 120/70 | 84 | 140/90 | 89 | 140/90 | 77 | 110/80 | 84 | 140/90 | 86 | 130/90 |
| 88 | 110/70 | 88 | 130/80 | 88 | 130/80 | 84 | 140/90 | 86 | 130/90 | 87 | 140/70 | 82 | 100/70 | 86 | 130/90 | 88 | 130/80 |
| 89 | 130/80 | 86 | 120/80 | 78 | 120/70 | 86 | 130/90 | 88 | 130/80 | 82 | 120/70 | 84 | 120/70 | 88 | 130/80 | 89 | 140/90 |
| 78 | 120/70 | 90 | 110/80 | 80 | 140/90 | 88 | 130/80 | 89 | 140/90 | 78 | 120/70 | 86 | 140/70 | 89 | 140/90 | 87 | 140/70 |
| 76 | 140/90 | 88 | 100/70 | 82 | 130/90 | 89 | 140/90 | 78 | 130/80 | 84 | 140/90 | 88 | 120/70 | 87 | 140/70 | 88 | 120/80 |
| 88 | 130/90 | 87 | 120/70 | 84 | 130/80 | 87 | 140/70 | 76 | 120/80 | 83 | 130/70 | 78 | 110/70 | 82 | 120/70 | 84 | 140/90 |
| 86 | 130/80 | 78 | 140/70 | 86 | 140/90 | 82 | 120/70 | 88 | 120/70 | 88 | 120/80 | 80 | 130/80 | 78 | 120/70 | 83 | 130/70 |
| 90 | 140/90 | 77 | 120/70 | 88 | 140/70 | 78 | 120/70 | 78 | 110/70 | 87 | 130/70 | 82 | 120/70 | 84 | 140/90 | 88 | 120/80 |
| 92 | 130/80 | 82 | 110/70 | 89 | 120/70 | 84 | 140/90 | 80 | 130/80 | 78 | 120/80 | 84 | 140/90 | 83 | 130/70 | 87 | 130/70 |
| 78 | 120/80 | 84 | 130/80 | 87 | 120/70 | 83 | 130/70 | 82 | 120/70 | 77 | 110/80 | 82 | 100/70 | 88 | 120/80 | 78 | 120/80 |
| 76 | 120/70 | 86 | 120/70 | 82 | 140/90 | 88 | 120/80 | 84 | 140/90 | 82 | 100/70 | 82 | 120/70 | 84 | 140/90 | 77 | 110/80 |
| 78 | 140/90 | 88 | 140/90 | 78 | 140/70 | 84 | 140/90 | 86 | 130/90 | 84 | 120/70 | 84 | 140/90 | 83 | 130/70 | 82 | 100/70 |
| 74 | 130/90 | 78 | 110/70 | 84 | 120/70 | 86 | 130/90 | 88 | 130/80 | 86 | 140/70 | 86 | 130/90 | 88 | 120/80 | 84 | 120/70 |
| 96 | 130/80 | 80 | 130/80 | 86 | 120/70 | 88 | 130/80 | 89 | 140/90 | 88 | 120/70 | 88 | 130/80 | 87 | 130/70 | 86 | 140/70 |
| 94 | 140/90 | 82 | 120/70 | 88 | 130/90 | 89 | 140/90 | 87 | 140/70 | 78 | 110/70 | 89 | 140/90 | 78 | 120/80 | 88 | 120/70 |
| 92 | 140/70 | 84 | 140/90 | 88 | 130/80 | 78 | 130/80 | 82 | 120/70 | 80 | 130/80 | 78 | 130/80 | 77 | 110/80 | 78 | 110/70 |
| 80 | 120/70 | 86 | 130/90 | 92 | 140/90 | 76 | 120/80 | 78 | 120/70 | 82 | 120/70 | 76 | 120/80 | 82 | 100/70 | 80 | 130/80 |
| 84 | 120/70 | 98 | 140/70 | 98 | 130/80 | 88 | 120/70 | 84 | 140/90 | 84 | 140/90 | 88 | 120/70 | 84 | 120/70 | 82 | 120/70 |

| GROUP 1 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 HRS | | 12 HRS | | 24 HRS | | VAS | | | | | | | | LEVEL OF SEDATION | SIDE EFFECTS | FIRST RESCUE ANALGESIA |
| PR | BP | PR | BP | PR | BP | 2 HRS | 4 HRS | 6 HRS | 8 HRS | 10 HRS | 12 HRS | 18 HRS | 24 HRS | | | |
| 77 | 110/80 | 82 | 120/70 | 80 | 130/80 | 0 | 0 | 1 | 3 | 4 | 5 | 5 | 6 | 2 | 0 | 380 |
| 82 | 100/70 | 78 | 120/70 | 82 | 120/70 | 0 | 0 | 2 | 4 | 4 | 5 | 5 | 5 | 2 | 0 | 390 |
| 84 | 120/70 | 84 | 140/90 | 84 | 140/90 | 0 | 0 | 1 | 3 | 4 | 5 | 5 | 6 | 2 | 0 | 300 |
| 86 | 140/70 | 83 | 130/70 | 86 | 130/90 | 0 | 0 | 2 | 3 | 4 | 5 | 5 | 5 | 2 | 0 | 400 |
| 88 | 120/70 | 88 | 120/80 | 88 | 130/80 | 0 | 0 | 2 | 3 | 5 | 6 | 6 | 6 | 2 | 0 | 380 |
| 78 | 110/70 | 87 | 130/70 | 89 | 140/90 | 0 | 0 | 2 | 3 | 4 | 5 | 4 | 5 | 2 | 0 | 350 |
| 80 | 130/80 | 78 | 120/80 | 78 | 130/80 | 0 | 0 | 2 | 3 | 5 | 5 | 4 | 6 | 2 | 0 | 360 |
| 82 | 120/70 | 76 | 120/80 | 76 | 120/80 | 0 | 0 | 2 | 3 | 4 | 6 | 4 | 5 | 1 | 0 | 380 |
| 84 | 140/90 | 88 | 120/70 | 88 | 120/70 | 0 | 1 | 3 | 3 | 5 | 5 | 5 | 6 | 2 | 0 | 360 |
| 86 | 130/90 | 78 | 110/70 | 78 | 110/70 | 0 | 1 | 2 | 4 | 4 | 4 | 4 | 6 | 2 | 0 | 350 |
| 88 | 130/80 | 80 | 130/80 | 80 | 130/80 | 0 | 0 | 2 | 4 | 5 | 5 | 4 | 5 | 2 | 0 | 410 |
| 89 | 140/90 | 82 | 120/70 | 82 | 120/70 | 0 | 0 | 2 | 4 | 4 | 5 | 5 | 6 | 2 | 0 | 400 |
| 78 | 130/80 | 84 | 140/90 | 84 | 140/90 | 0 | 0 | 1 | 4 | 4 | 5 | 5 | 6 | 2 | 0 | 420 |
| 76 | 120/80 | 86 | 130/90 | 86 | 130/90 | 0 | 2 | 3 | 4 | 4 | 5 | 6 | 5 | 1 | 0 | 400 |
| 88 | 120/70 | 88 | 130/80 | 88 | 120/80 | 0 | 0 | 3 | 3 | 5 | 5 | 5 | 6 | 2 | 0 | 410 |
| 78 | 110/70 | 89 | 140/90 | 87 | 130/70 | 0 | 0 | 2 | 3 | 5 | 5 | 5 | 6 | 1 | 0 | 360 |
| 80 | 130/80 | 87 | 140/70 | 78 | 120/80 | 0 | 0 | 2 | 3 | 5 | 5 | 5 | 6 | 2 | 0 | 380 |
| 82 | 120/70 | 82 | 120/70 | 77 | 110/80 | 0 | 1 | 2 | 3 | 5 | 5 | 5 | 7 | 2 | 0 | 390 |
| 84 | 140/90 | 84 | 140/90 | 82 | 100/70 | 0 | 0 | 2 | 3 | 4 | 5 | 6 | 6 | 1 | 0 | 450 |
| 86 | 130/90 | 86 | 130/90 | 84 | 120/70 | 0 | 0 | 1 | 3 | 4 | 4 | 5 | 7 | 2 | 0 | 460 |
| 88 | 120/80 | 88 | 130/80 | 86 | 140/70 | 0 | 2 | 3 | 2 | 4 | 5 | 6 | 6 | 2 | 0 | 350 |
| 87 | 130/70 | 89 | 140/90 | 88 | 120/70 | 0 | 1 | 2 | 3 | 5 | 6 | 6 | 7 | 2 | 0 | 360 |
| 78 | 120/80 | 78 | 130/80 | 78 | 110/70 | 0 | 0 | 2 | 3 | 5 | 5 | 6 | 7 | 2 | 0 | 320 |
| 77 | 110/80 | 76 | 120/80 | 80 | 130/80 | 0 | 1 | 2 | 3 | 5 | 6 | 6 | 6 | 1 | 0 | 330 |
| 82 | 100/70 | 88 | 120/70 | 78 | 120/70 | 0 | 1 | 1 | 3 | 5 | 5 | 6 | 7 | 2 | 0 | 300 |
| 84 | 120/70 | 88 | 130/80 | 73 | 120/80 | 0 | 1 | 2 | 3 | 6 | 5 | 4 | 6 | 2 | 0 | 400 |
| 86 | 140/70 | 89 | 140/90 | 71 | 130/70 | 0 | 2 | 3 | 3 | 6 | 5 | 5 | 6 | 2 | 0 | 360 |
| 88 | 120/70 | 87 | 140/70 | 75 | 120/80 | 0 | 1 | 2 | 2 | 5 | 5 | 5 | 6 | 1 | 0 | 380 |
| 78 | 110/70 | 88 | 120/80 | 74 | 110/80 | 0 | 2 | 3 | 4 | 6 | 5 | 6 | 6 | 2 | 0 | 390 |
| 80 | 130/80 | 84 | 140/90 | 76 | 100/70 | 0 | 2 | 3 | 4 | 6 | 5 | 5 | 6 | 2 | 0 | 350 |

| GROUP 2 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.NO | NAME | AGE | SEX | WT | ASA | DURATION OF SURGERY | PRE OP | | | ONSET SENSORY BLOCK | ONSET MOTOR BLOCK | SENSORY BLOCK DURATION | MOTOR BLOCK DURATION |
| | | | | | | | PR | BP | SPO2 | | | | |
| 1 | SUMITHRA | 24 | F | 65 | 1 | 110 | 78 | 110/70 | 99 | 10 | 13 | 380 | 320 |
| 2 | NAGARATHINAM | 49 | M | 59 | 2 | 98 | 80 | 130/80 | 100 | 9 | 13 | 420 | 330 |
| 3 | RANJANI | 34 | F | 63 | 1 | 89 | 74 | 120/80 | 98 | 9 | 14 | 390 | 340 |
| 4 | KRISHNAMOORTRHY | 63 | M | 60 | 2 | 102 | 98 | 150/90 | 99 | 11 | 12 | 430 | 360 |
| 5 | SUGANTHI | 35 | F | 48 | 1 | 106 | 90 | 100/60 | 99 | 10 | 13 | 425 | 320 |
| 6 | PRABHADEVI | 46 | F | 52 | 1 | 100 | 92 | 130/80 | 100 | 8 | 12 | 410 | 310 |
| 7 | MANGALESWARI | 39 | F | 70 | 1 | 95 | 85 | 140/80 | 100 | 8 | 11 | 455 | 300 |
| 8 | PANDI | 65 | M | 63 | 2 | 90 | 86 | 150/90 | 100 | 9 | 12 | 470 | 350 |
| 9 | JOTHILAKSHMI | 63 | F | 58 | 2 | 75 | 82 | 120/90 | 98 | 10 | 13 | 395 | 360 |
| 10 | MEENAKSHI | 60 | F | 60 | 2 | 80 | 75 | 140/90 | 99 | 9 | 12 | 405 | 330 |
| 11 | NAJIMA | 58 | F | 59 | 1 | 95 | 79 | 130/90 | 98 | 9 | 12 | 410 | 360 |
| 12 | PERUMAL | 49 | M | 62 | 1 | 90 | 68 | 120/80 | 99 | 9 | 11 | 420 | 340 |
| 13 | MUNIYANDI | 62 | M | 45 | 1 | 110 | 80 | 140/80 | 99 | 7 | 12 | 390 | 350 |
| 14 | PUSHPAM | 55 | F | 63 | 1 | 110 | 95 | 130/70 | 99 | 10 | 13 | 380 | 360 |
| 15 | PARABADEVI | 49 | F | 73 | 1 | 100 | 92 | 120/80 | 97 | 10 | 12 | 370 | 370 |
| 16 | VASUDEVAN | 49 | M | 60 | 1 | 120 | 90 | 110/80 | 98 | 11 | 14 | 380 | 320 |
| 17 | KALYANI | 38 | F | 55 | 1 | 110 | 86 | 110/80 | 99 | 12 | 13 | 400 | 330 |
| 18 | BALUISAMY | 59 | M | 49 | 2 | 100 | 83 | 130/90 | 98 | 11 | 12 | 390 | 310 |
| 19 | RAMALINGAM | 46 | M | 63 | 1 | 105 | 78 | 120/70 | 100 | 10 | 13 | 385 | 330 |
| 20 | AARTHY | 23 | F | 62 | 1 | 110 | 74 | 100/70 | 100 | 12 | 12 | 360 | 340 |
| 21 | THIYAGARAJAN | 60 | M | 56 | 2 | 95 | 73 | 130/90 | 100 | 13 | 11 | 350 | 325 |
| 22 | SUMATHI | 33 | F | 70 | 1 | 90 | 72 | 110/70 | 98 | 12 | 12 | 400 | 300 |
| 23 | RAJA | 40 | M | 69 | 1 | 85 | 89 | 120/70 | 99 | 11 | 13 | 390 | 290 |
| 24 | SUDHAKAR | 34 | M | 74 | 2 | 90 | 88 | 130/80 | 97 | 12 | 12 | 380 | 290 |
| 25 | MANIMARAN | 36 | M | 68 | 1 | 80 | 79 | 100/70 | 98 | 10 | 12 | 420 | 300 |
| 26 | JEYANTHI | 45 | F | 52 | 1 | 90 | 76 | 140/90 | 99 | 10 | 11 | 400 | 300 |
| 27 | SELVARAJ | 51 | M | 70 | 2 | 95 | 100 | 160/100 | 99 | 9 | 12 | 410 | 310 |
| 28 | RAMACHANDRAN | 56 | M | 69 | 2 | 100 | 106 | 150/90 | 100 | 8 | 12 | 390 | 325 |
| 29 | SIVAGAMI | 36 | F | 62 | 1 | 110 | 78 | 120/70 | 100 | 9 | 12 | 400 | 320 |
| 30 | BASKAR | 30 | M | 78 | 1 | 120 | 98 | 130/80 | 98 | 10 | 14 | 380 | 330 |

| GROUP 2 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 MINS | | 30 MIMS | | 45 MINS | | 60 MINS | | 1 HR 15 MINS | | 1 HR 30 MINS | | 1 HR 45 MINS | | 2 HRS | | 4 HRS | |
| PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP | PR | BP |
| 79 | 130/70 | 92 | 110/70 | 78 | 100/70 | 86 | 100/60 | 78 | 120/70 | 78 | 120/80 | 82 | 120/70 | 78 | 140/90 | 95 | 130/80 |
| 68 | 120/80 | 90 | 120/70 | 98 | 140/90 | 83 | 130/80 | 98 | 100/70 | 86 | 140/80 | 84 | 100/70 | 90 | 110/70 | 89 | 100/70 |
| 80 | 110/80 | 86 | 130/80 | 90 | 110/70 | 78 | 140/80 | 90 | 130/90 | 78 | 130/70 | 78 | 130/90 | 85 | 130/80 | 75 | 140/90 |
| 95 | 110/80 | 83 | 100/70 | 80 | 130/80 | 74 | 150/90 | 80 | 110/70 | 85 | 120/80 | 90 | 110/70 | 87 | 120/80 | 74 | 110/70 |
| 92 | 130/90 | 78 | 140/90 | 78 | 120/80 | 73 | 120/90 | 78 | 120/70 | 86 | 110/80 | 85 | 120/70 | 95 | 150/90 | 70 | 130/80 |
| 90 | 120/70 | 74 | 110/70 | 86 | 150/90 | 72 | 140/90 | 86 | 130/80 | 68 | 110/80 | 87 | 130/80 | 89 | 100/60 | 68 | 140/90 |
| 86 | 100/70 | 73 | 130/80 | 78 | 100/60 | 89 | 130/90 | 78 | 100/70 | 80 | 130/90 | 95 | 100/70 | 75 | 130/80 | 96 | 110/70 |
| 83 | 130/90 | 72 | 120/80 | 85 | 130/80 | 88 | 120/80 | 85 | 140/90 | 95 | 120/70 | 89 | 140/90 | 74 | 140/80 | 95 | 120/70 |
| 78 | 110/70 | 89 | 150/90 | 86 | 140/80 | 79 | 140/80 | 86 | 160/100 | 92 | 100/70 | 75 | 110/70 | 70 | 150/90 | 78 | 130/80 |
| 74 | 120/70 | 88 | 100/60 | 68 | 150/90 | 76 | 130/70 | 90 | 150/90 | 90 | 130/90 | 74 | 120/70 | 68 | 120/90 | 80 | 100/70 |
| 73 | 130/80 | 79 | 130/80 | 80 | 120/90 | 100 | 120/80 | 78 | 120/70 | 86 | 110/70 | 70 | 130/80 | 96 | 140/90 | 84 | 140/90 |
| 72 | 100/70 | 76 | 140/80 | 95 | 140/90 | 106 | 110/80 | 80 | 130/80 | 83 | 120/70 | 68 | 100/70 | 95 | 130/90 | 86 | 110/70 |
| 89 | 140/90 | 100 | 150/90 | 92 | 130/90 | 78 | 110/80 | 80 | 120/80 | 68 | 130/80 | 96 | 140/90 | 78 | 120/80 | 89 | 130/80 |
| 88 | 110/70 | 106 | 120/90 | 90 | 120/80 | 98 | 130/90 | 95 | 150/90 | 80 | 100/70 | 95 | 110/70 | 80 | 110/80 | 89 | 120/80 |
| 79 | 130/80 | 78 | 140/90 | 86 | 110/80 | 90 | 120/70 | 92 | 100/60 | 95 | 140/90 | 78 | 130/80 | 84 | 110/80 | 95 | 150/90 |
| 76 | 120/80 | 98 | 130/90 | 83 | 110/80 | 80 | 100/70 | 90 | 130/80 | 92 | 110/70 | 80 | 120/80 | 86 | 130/90 | 96 | 100/60 |
| 100 | 150/90 | 90 | 120/80 | 68 | 130/90 | 78 | 130/90 | 86 | 140/80 | 90 | 120/70 | 84 | 150/90 | 89 | 120/70 | 87 | 110/70 |
| 106 | 100/60 | 80 | 110/80 | 80 | 120/70 | 86 | 110/70 | 83 | 150/90 | 86 | 130/80 | 86 | 100/60 | 89 | 100/70 | 89 | 130/80 |
| 78 | 130/80 | 78 | 110/80 | 95 | 100/70 | 78 | 120/70 | 78 | 120/90 | 83 | 100/70 | 89 | 110/70 | 95 | 130/90 | 79 | 120/80 |
| 98 | 140/80 | 86 | 130/90 | 92 | 130/90 | 85 | 130/80 | 74 | 140/90 | 78 | 140/90 | 93 | 130/80 | 96 | 130/90 | 82 | 110/70 |
| 90 | 150/90 | 78 | 120/70 | 90 | 130/90 | 86 | 100/70 | 73 | 130/90 | 74 | 110/70 | 91 | 120/80 | 87 | 130/70 | 68 | 130/80 |
| 80 | 120/90 | 85 | 100/70 | 86 | 120/80 | 90 | 140/90 | 72 | 120/80 | 73 | 130/80 | 100 | 150/90 | 89 | 120/80 | 80 | 120/80 |
| 78 | 140/90 | 86 | 130/90 | 83 | 130/80 | 78 | 130/70 | 89 | 140/80 | 72 | 120/80 | 102 | 100/60 | 79 | 110/80 | 95 | 150/90 |
| 86 | 130/90 | 68 | 110/70 | 78 | 100/70 | 80 | 120/80 | 88 | 130/70 | 80 | 150/90 | 89 | 130/80 | 82 | 110/80 | 92 | 100/60 |
| 78 | 120/80 | 80 | 120/70 | 74 | 140/90 | 90 | 110/80 | 79 | 120/80 | 95 | 100/60 | 95 | 140/80 | 68 | 130/90 | 90 | 130/80 |
| 85 | 130/80 | 95 | 130/80 | 73 | 110/70 | 80 | 110/80 | 86 | 110/80 | 92 | 130/80 | 96 | 150/90 | 80 | 120/70 | 84 | 140/80 |
| 86 | 100/70 | 92 | 100/70 | 72 | 120/70 | 78 | 130/90 | 83 | 110/80 | 90 | 140/80 | 87 | 120/90 | 95 | 100/70 | 86 | 150/90 |
| 90 | 140/90 | 90 | 140/90 | 89 | 100/60 | 86 | 120/70 | 78 | 130/90 | 86 | 150/90 | 89 | 140/90 | 92 | 130/90 | 89 | 120/90 |
| 78 | 110/70 | 86 | 110/70 | 88 | 130/80 | 78 | 100/70 | 74 | 120/70 | 83 | 120/90 | 79 | 120/70 | 90 | 110/70 | 89 | 140/90 |
| 80 | 120/70 | 83 | 130/80 | 79 | 110/70 | 85 | 130/90 | 73 | 100/70 | 68 | 130/80 | 82 | 110/80 | 88 | 120/70 | 95 | 130/90 |

| GROUP 2 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 HRS | | 12 HRS | | 24 HRS | | VAS | | | | | | | | LEVEL OF SEDATION | SIDE EFFECTS | FIRST RESCUE ANALGESIA |
| PR | BP | PR | BP | PR | BP | 2 HRS | 4 HRS | 6 HRS | 8 HRS | 10 HRS | 12 HRS | 18 HRS | 24 HRS | | | |
| 80 | 120/80 | 87 | 100/70 | 96 | 110/80 | 0 | 0 | 0 | 2 | 2 | 3 | 3 | 4 | 2 | 0 | 450 |
| 74 | 120/90 | 95 | 140/90 | 87 | 130/90 | 0 | 0 | 0 | 2 | 2 | 3 | 4 | 5 | 2 | 0 | 500 |
| 98 | 140/90 | 89 | 110/70 | 89 | 100/60 | 0 | 0 | 1 | 2 | 3 | 3 | 3 | 4 | 2 | 0 | 480 |
| 90 | 130/90 | 75 | 120/70 | 79 | 110/70 | 0 | 0 | 0 | 2 | 3 | 3 | 3 | 5 | 2 | 0 | 300 |
| 92 | 120/80 | 74 | 130/80 | 82 | 130/80 | 0 | 0 | 0 | 3 | 3 | 4 | 3 | 5 | 1 | 0 | 390 |
| 85 | 110/80 | 70 | 100/70 | 68 | 120/80 | 0 | 0 | 0 | 2 | 3 | 3 | 3 | 4 | 2 | 0 | 300 |
| 86 | 110/80 | 68 | 140/90 | 80 | 150/90 | 0 | 0 | 2 | 2 | 3 | 3 | 3 | 4 | 2 | 0 | 450 |
| 82 | 130/90 | 96 | 110/70 | 95 | 100/60 | 0 | 0 | 1 | 3 | 3 | 3 | 3 | 4 | 2 | 0 | 470 |
| 75 | 120/70 | 95 | 130/80 | 92 | 130/80 | 0 | 0 | 2 | 2 | 3 | 4 | 4 | 4 | 2 | 0 | 480 |
| 79 | 100/70 | 78 | 120/80 | 90 | 140/80 | 0 | 0 | 2 | 3 | 3 | 3 | 4 | 4 | 1 | 0 | 520 |
| 68 | 130/90 | 80 | 150/90 | 84 | 130/80 | 0 | 0 | 3 | 3 | 3 | 4 | 3 | 5 | 2 | 0 | 500 |
| 80 | 130/90 | 84 | 100/60 | 86 | 140/80 | 0 | 0 | 2 | 2 | 3 | 3 | 4 | 4 | 2 | 0 | 530 |
| 95 | 130/70 | 86 | 110/70 | 89 | 150/90 | 0 | 0 | 2 | 3 | 3 | 3 | 3 | 5 | 2 | 0 | 450 |
| 92 | 120/80 | 89 | 130/80 | 89 | 120/90 | 0 | 0 | 2 | 2 | 2 | 4 | 3 | 4 | 2 | 0 | 360 |
| 90 | 110/80 | 98 | 120/80 | 95 | 140/90 | 0 | 0 | 2 | 3 | 3 | 3 | 3 | 5 | 2 | 0 | 350 |
| 86 | 110/70 | 90 | 150/90 | 80 | 130/90 | 0 | 0 | 2 | 3 | 3 | 4 | 3 | 4 | 2 | 0 | 390 |
| 83 | 120/70 | 92 | 100/60 | 84 | 120/80 | 0 | 0 | 2 | 3 | 2 | 3 | 3 | 4 | 1 | 0 | 320 |
| 78 | 130/80 | 85 | 130/80 | 86 | 100/60 | 0 | 0 | 0 | 2 | 2 | 3 | 3 | 5 | 2 | 0 | 330 |
| 74 | 100/70 | 86 | 140/80 | 89 | 130/80 | 0 | 0 | 2 | 2 | 3 | 3 | 3 | 5 | 2 | 0 | 490 |
| 73 | 140/90 | 82 | 130/80 | 98 | 140/80 | 0 | 0 | 1 | 2 | 3 | 4 | 4 | 4 | 2 | 0 | 460 |
| 72 | 110/70 | 75 | 140/80 | 90 | 150/90 | 0 | 0 | 2 | 2 | 3 | 3 | 3 | 4 | 2 | 0 | 480 |
| 89 | 120/70 | 79 | 150/90 | 92 | 120/90 | 0 | 0 | 2 | 3 | 3 | 3 | 4 | 5 | 1 | 0 | 510 |
| 88 | 130/80 | 68 | 120/90 | 85 | 140/90 | 0 | 0 | 3 | 3 | 3 | 3 | 4 | 4 | 1 | 0 | 500 |
| 79 | 100/70 | 78 | 140/90 | 86 | 130/90 | 0 | 0 | 2 | 3 | 3 | 4 | 4 | 4 | 2 | 0 | 450 |
| 70 | 140/90 | 74 | 130/90 | 82 | 120/80 | 0 | 0 | 2 | 3 | 3 | 3 | 3 | 4 | 2 | 0 | 490 |
| 68 | 110/70 | 73 | 120/80 | 75 | 110/80 | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 4 | 2 | 0 | 460 |
| 96 | 130/80 | 72 | 140/80 | 79 | 110/80 | 0 | 0 | 2 | 2 | 3 | 4 | 3 | 5 | 2 | 0 | 390 |
| 95 | 120/80 | 89 | 130/70 | 89 | 130/90 | 0 | 0 | 3 | 3 | 2 | 3 | 3 | 5 | 1 | 0 | 380 |
| 78 | 120/70 | 88 | 120/80 | 89 | 120/70 | 0 | 0 | 2 | 3 | 3 | 3 | 3 | 4 | 1 | 0 | 390 |
| 80 | 110/80 | 79 | 110/80 | 88 | 130/80 | 0 | 0 | 0 | 2 | 2 | 3 | 3 | 5 | 2 | 0 | 450 |

# MADURAI MEDICAL COLLEGE
## MADURAI, TAMILNADU, INDIA -625 020
(Affiliated to The Tamilnadu Dr.MGR Medical University,
Chennai, Tamil Nadu)



## *ETHICS COMMITTEE CERTIFICATE*

| | | |
|---|---|---|
| Name of the Candidate | : | Dr.G.Manikandan |
| Course | : | PG in MD., Anaesthesia |
| Period of Study | : | 2016-2019 |
| College | : | MADURAI MEDICAL COLLEGE |
| Research Topic | : | Ultrasound guided supraclavicular brachial plexus block using verapamil adjuvant to local anaesthetic for upper limb surgery |
| Ethical Committee as on | : | 10.07.2018 |

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary

Chairman
Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.,(Neuro), Dsc (Hon
CHAIRMAN
IEC - Madurai Medical College
Madurai

Dean / Convenor
DEAN
Madurai Medical College
Madurai-20

17 JUL 2018

URKUND

# Urkund Analysis Result

| | |
|---|---|
| Analysed Document: | disser.docx (D42072691) |
| Submitted: | 10/3/2018 12:28:00 PM |
| Submitted By: | dr.manikandan89@gmail.com |
| Significance: | 0 % |

Sources included in the report:

Instances where selected sources appear:

0